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SOME ENGINEERING HINTS FROM UTAH.

The valley of the Great Salt Lake has been well supplied with hydroelectric service, yet its continuous growth in prosperity has called always for still more power. The latest of the hydroelectric plants to be put into its service is described in this issue. This is the Riverdale plant of the Davis & Weber Counties Canal Company. Like many other important projects in the West, this started as an irrigation system and it is only lately that the hydroelectric plant has been developed. Many of the ditch companies throughout the West wasted for years great waterpowers, the country being largely agricultural and their whole attention being directed to the supply of irrigation water. Hence the ditches, drawing their water from the mountains at a high level, brought it down to the plains without extracting the energy from it. The process reminds one of the early phases of gold mining, when the tailings carried away the major portion of the gold. In this instance it was found that the concrete ditch running far up into the Weber Canyon for the purpose of bringing water to the farms on the plains below had the potential possibility of something over 13,000 hp with a 200-foot head available between the high-level canal and the river whence the water was taken. The present plant utilizes 3750 hp of this amount.

The most advantageous point for a plant unfortunately was one where the ditch was carried more than half a mile from the riverbed. To bring the water to the wheels a rather unusual construction was therefore adopted, consisting of very large steel penstocks 1400 ft. long, bringing the water about half way from the ditch to the river in gaining the full head available. About the same length of excavated tailrace connects the draft tubes of the plant with the river. Most of the drop in the penstocks is in the first 400 ft. and the steel tubes are carried on concrete saddle piers resting on gravel. There are two wheels, one driving a 2500-kw unit, the other a 1250-kw machine. The initial diameter of the penstock for the former is 87 in., of that for the latter 65. The lower sections of the penstocks are about double the thickness of the upper sections to gain the necessary strength against the inertia strains due to rapid governing. To avoid further the same difficulty the wheel governors automatically work by-pass valves to relieve the pressure, as well as the turbine gates themselves. To save water these synchronous relief valves gradually close after the governor movement has taken place so as to stop the water without undue shock. In the generating units there is nothing in the least unusual except perhaps that the flywheels are rather heavier than those commonly employed under such work.

Perhaps the most interesting feature of the plant, how-

ever, is an ingenious scheme for paying Paul without robbing Peter. There is a small independent ditch line which formerly has tapped the river above the present site of the plant. By arrangement with the farmers owning it, the water from this ditch at times of low water is deflected into the main canal of the power plant, where its entire 206-ft. fall is utilized. Then from the tailrace an equal amount of water is returned to the ditch at a sufficiently high level to insure its full and adequate flow. One 100-hp induction motor driving a centrifugal pump does the trick, the total lift being 30 ft. The Riverdale plant therefore gains a 200-ft. head from the water and puts back 30 ft. of head to meet the irrigation requirements. The added water of the little canal gives 325 hp, and this unique device therefore adds a net 225 hp to the minimum output of the plant while supplying water to the farms below.

UTILIZATION OF ELECTRIC IRONS.

An article printed on page 1183 in this issue presents some interesting information in regard to the sale of electric irons by central stations. Furnishing an off-peak load of considerable importance, the use of this energy-consuming device has received much attention, in many cases with most gratifying results. The present article does not disclose any new business methods but again directs attention to the necessity of educating the public as to the advantages of electricity in the household.

It is of interest to note that 59 per cent of all central stations reporting are selling irons at list price or above, and still more interesting is the fact that those selling at this price are evidently furnishing irons to as large a percentage of their customers as are those selling below list prices. This fact inevitably suggests the desirability of the central stations upholding the price and inviting co-operation from the electrical supply dealers. In many cases the central station has had to carry the whole burden of local advertising and demonstrations, and it has consequently felt justified in handling the matter of price according to its own ideas. Where nothing is to be gained in sales the central station should work hand in hand with the dealer and derive the increased income on the sales and at the same time the increase in load from the irons sold by the dealer. Co-operation in this case cannot fail ultimately to benefit the central station and incidentally also the dealer.

A SUCCESSFUL APPLIANCE CAMPAIGN.

We have frequently called attention to the importance of the electric-heating-appliance load to central stations. Central-station managers have been in this matter conservative, slow to move, and generally lukewarm. It has taken a good many years to bring heating appliances of the smaller domestic sort into anything like common use, and the fault has by no means been attributable to the appliances. If one were to attempt to analyze the reasons why this particular outlet for the sale of electric energy has been neglected, he would probably find the chief one to lie in the fact that until within very recent years lighting was about the only source of revenue concerning which the central-station man was really enthusiastic. In earlier times the prices for lighting were high, prohibitively high for the extended use of electrical appliances generally, and it is only as the lighting field has become more or less well covered and the prices for energy have fallen from the exploitation to the commercial basis that appliances have had a fair chance. Even now a good many central-station managers, chiefly among the older and less progressive men in the business, look on the small consumer as unprofitable and his patronage as scarcely worth the effort. This they do unmindful of the fact that the gas companies live and do business and pay fat dividends chiefly on the very class of patronage which they affect to despise.

The account we publish this week of the campaign of the Southern California Edison Company in exploiting the use of energy for other purposes than lighting and motor service will be a revelation, and ought to be a spur, to many easy-going managers. Our readers are familiar with the great network operated by this extremely energetic and prosperous company, which fully realized that, while its lighting field was vigorously exploited, there remained large opportunities for the sale of energy to constitute chiefly a day load, the more fully to load its lines and economize its water-power. Hence the campaign which we are here considering. It started several years ago along the ordinary lines of advertising and circularizing, with a copious display of household appliances. The advertisements went for the most part unread, the circulars were, as usual, filed in the waste-basket, and few people went out of their way to see the appliances. Then the company changed its tactics and inaugurated a house-to-house still hunt, which is first, last and always the most effective way of getting any kind of business which really needs pushing. It put out a set of canvassers, paid largely on commission, who promptly began to sell goods, and presently the sales end of the enterprise was on a business basis.

Last year the sales of appliances amounted to $120,000, in spite of the fact that the business-getting effort was directed to only a few kinds of appliances, chiefly those that would go on ordinary lighting circuits and furnish a fair amount of use. Flatirons, toasters, grills and percolators were the chief articles sold. About 25,000 appliances were sold last year alone, bringing the total on the circuits up to about 90,000. These average about 500 watts in consumption when in use, and the average monthly use is from ten to twelve hours. This value does not seem large, but in the course of a year it counts up, and if one reckons no more than $5 per year per appliance in the sale of energy, the total amount of income derived from this source rises to a figure not by any means to be despised even on a large system, particularly when one considers that it is gained simply by a slightly more effective use of the existing distributing system, to which it adds nothing for expense. The curves showing the load due almost entirely to these various appliances in a substation where there is no industrial load are instructive in a high degree. They indicate that the business won is practically entirely a day load and almost entirely off the peak. Large as have been the returns from this wise and well-conducted campaign, it must be borne in mind that the company has barely touched the larger heating business. This can be obtained

on terms at least as favorable as motor business and is for the most part off-the-peak business. It is even more desirable in character than is motor load. Air-heating appliances are used chiefly in the morning and after sunset when the chill of the evening comes on. Electric ranges as a rule come into full action just after the chief lighting peak is passed. They inflict very little lap-load and hence form an exceedingly desirable class of business. This larger work, which can certainly be cultivated in many cities with admirable results, has hardly been touched. It deserves assiduous attention as the means of building up profitable day load and improving the load-factor. At prices already familiar in motor business the larger heating work can be profitably undertaken. Profit in the smaller heating work speaks for itself. Unless we greatly mistake the situation, the next ten years will see a very large increase in this class of energy consumption, and it is time for enterprising central stations to wake up and make the most of their opportunities.

THE LIFE OF PLANT.

The proper estimate for depreciation in any part of a plant depends on the probable duration of life in the part considered. The actual duration cannot be foretold and will depend upon the quality of construction, the care exercised in operation, the degree of supervision and swiftness of repairs, not to mention the element of chance. Nevertheless, just as, although the actual duration of any particular human being cannot be precisely foretold, yet carefully recorded experience will enable a very reliable estimate to be obtained of the average life of a thousand human beings, so too can a similar estimate be made for a thousand individual machines. The question of replacement or supersession during the working lifetime of a plant does not enter into this consideration. If the plant is proper to install at the time when installation is necessary, then no improved plant should logically be allowed to supersede it, for economical reasons, unless the saving effected by such new plant can pay interest and depreciation on the old plant over and above its own charges. Consequently, no plant can properly be sold off, superannuated or thrown on the scrap heap for economical reasons unless its interest and depreciation funds have been protected.

The Electrician, our esteemed British contemporary, has recently collected information from central lighting stations of more than twenty years' standing as to what portions of the original plant are still in service. The published reports referred to in our *Digest* go to show that in Great Britain the duration of life for engines and generators is often more than twenty years, while that of street mains is more nearly thirty years. These indications may be regarded as satisfactory from a purely economical standpoint. It cannot be safely deduced, however, that because such durations of life have been found in Great Britain similar durations might have been expected for like plants in other parts of the world, say the United States or Canada. Rates of expansion, habits of mind, stability of structure and tenure are all very different in rapidly growing countries compared with countries in which conditions have long been established by settled usage.

In any newly established industry whose success is open to question the depreciation factor is so doubtful as to become secondary in importance. Temporary construction and minimum first cost become salient considerations. Only persons of enterprise and abundant confidence will risk money in the venture. After a time, as the enterprise becomes more settled and its prospects more secure, capital becomes more willing to enter the plant. The excessive profits that encouraged the early risks dwindle, but the reasonable profits become, instead, more definite. Depreciation now begins to be considered more seriously. As time goes on and the enterprise expands, the profits tend to fall to the mean value for the particular commercial period and country. At the same time, the rate of depreciation becomes more definitely known by experience, and its exact value becomes of ever-increasing importance. A slight increase in rate of depreciation may become capable of driving capital away from a plant whose profit-producing capacity is limited by legislation while its charges have long been settled by experience.

THE ABSORPTION OF GASES IN VACUUM TUBES.

It is well known that vacuum tubes tend to develop higher vacuums in service. That is, a glass tube which originally contained air but which has been exhausted and sealed, with electrodes in its walls, tends to reach a higher degree of vacuum after it has carried electrical discharges for some time. X-ray tubes and Moore tubes are instances in point. The question naturally arises as to whether the residual gases disappear by chemical or by physical action. Do they combine chemically with the substance of the glass walls or of the metallic electrodes, or do they disappear from the gas in the tube, by some physical action such as endosmose? A paper recently read by Mr. S. E. Hill before the Physical Society of Great Britain describes experimental results tending to favor the chemical theory. It was found that small quantities of hydrogen introduced into a tube that had improved its vacuum showed distinct hydrogen absorption, such as might be looked for if the walls of glass had become slightly oxidized.

In practice, the increase in the degree of vacuum reached speedily by working vacuum tubes is so marked as to constitute in many cases a serious difficulty. Both in X-ray tubes and in Moore tubes means are frequently provided for maintaining automatically the desired degree of vacuum. At ordinary atmospheric pressures it is known that only the air molecules lying near to the walls of a glass tube have much chance of coming into contact with the walls. All the more remote interior molecules spend their time in rapid vibratory motion, each particle tending to occupy a mean position from which it is driven only by wind or convection currents. In a vacuum tube, however, the mean free path of the residual gas molecules is so far increased that each molecule may expect to come into contact with the walls at fairly frequent intervals. Whether the action of absorption be chemical or physical, each gas molecule becomes subjected to the action relatively often. A distinctly evident rise in vacuum with service is, therefore, not surprising.

DECEMBER MEETING A. I. E. E.

A meeting of the American Institute of Electrical Engineers will be held in New York on Dec. 13 in the Engineering Societies Building, under the auspices of the high-tension transmission committee. Two papers will be presented as follows: "Comparative Tests on High-Tension Suspension Insulators," by Mr. P. W. Sothman, and "High-Frequency Tests of Line Insulators," by Messrs. L. E. Imlay and Percy H. Thomas. Following the technical session the meeting will adjourn to the Institute offices, where a smoker will be held.

ANNUAL CONVENTION A. S. M. E.

The thirty-third annual meeting of the American Society of Mechanical Engineers, held in the Engineering Societies Building, New York, Dec. 3 to 6, was opened Tuesday evening with a reception and an address by President Alex. C. Humphreys on the subject "The Present Opportunities and Consequent Responsibilities of the Engineer." During the evening the results of the recent election of officers were announced as follows: President, Prof. W. F. M. Goss, University of Illinois, Urbana; vice-presidents, Messrs. James Hartness, Springfield, Vt.; I. E. Moultrop, Boston, Mass., and H. G. Stott, New York; managers—Messrs. W. B. Jackson, Chicago; H. M. Leland, Detroit, Mich., and Alfred Noble, New York; treasurer, Mr. W. H. Wiley, East Orange, N. J. Reports of officers and committee chairmen occupied the business session of Wednesday morning, which was followed by parallel meetings of the power-plant, gas-power and textile sessions of the society. The paper by Mr. C. R. Weymouth, "Dimensions of Boiler Chimneys for Crude Oil," was presented in the author's absence by Dr. D. S. Jacobus, New York. Mr. B. N. Bump also abstracted his paper on "Tests of a 1000-hp, Twenty-four-Tube-High B. & W. Boiler." The technical program announced was continued over into Wednesday afternoon and in the various specialized sessions held on succeeding days of the convention. On Wednesday evening there was a reception and dinner to Prof. J. E. Sweet, and on Thursday evening Mr. R. W. Hunt was formally honored with the John Fritz medal for 1912.

The dinner to Professor Sweet was the first ever served in the Engineering Societies Building. More than 200 of the members and guests of the society attended. The toastmaster was Past-president Ambrose Swasey, maker of the Lick, Yerkes and other telescopes, and the address of welcome was delivered by the retiring president of the society, Dr. Alexander C. Humphreys.

MEETING OF ELECTRIC VEHICLE ASSOCIATION OF AMERICA.

Several hundred electric-vehicle men attended the meeting of the Electric Vehicle Association of America which was held at the Engineering Societies Building, New York, Nov. 26. Mr. Arthur Williams, of the New York Edison Company, the new president of the association, acted as chairman. The greater part of the evening was spent discussing the papers which were read at the third annual convention, held in Boston in October. In one of the papers, dealing with the cost of electric-vehicle operation, it was stated that a 1000-lb. wagon effected a saving of $400 a year over a 1000-lb. horse equipment, and that a 5-ton electric truck effected a saving of $1,100 a year over a horse equipment capable of doing the same work. These figures were gone into thoroughly and found to be correct.

Advertising was one of the important matters brought up and the members agreed that last year's advertising had accomplished good results—in fact, the spirit of approval was so general that the association expects to raise $100,000 for advertising next year, instead of $50,000, which was last year's advertising appropriation.

President Williams stated that the New York Electric Vehicle Association will probably soon take its place as a section of the Electric Vehicle Association of America. A standard design for an official garage sign was adopted. It consists of white letters reading "Electric Vehicle Charging" on a blue background, with the emblem of the association in the center. The sign is to be 4 ft. long and 2.5 ft. wide. It will be sent to garages everywhere in the United States which have electric-vehicle-charging stations.

PATENT COMMISSION RECOMMENDED BY THE BOARD OF DIRECTORS OF THE A. I. E. E.

At a meeting of the board of directors of the American Institute of Electrical Engineers held on Nov. 8 resolutions were adopted recommending to Congress the creation of an unbiased independent commission to prepare an exhaustive report on the patent system, with recommendations for whatever legislation may be needed. The text of the resolutions is here given in full:

"Whereas there are pending before the Congress numerous bills affecting and greatly modifying the patent system in the United States; and

"Whereas the patent system has been and is a tremendous factor in building up the present industrial prosperity of this country, thereby greatly contributing to the prosperity of the country as a whole; and

"Whereas any untoward change in the patent situation might disastrously affect this condition of industrial and general prosperity and the conditions contributing to its continual augmentation; and

"Whereas, in view of the intimate relation of the patent system to the general welfare, no action looking toward any radical change in the patent system should be taken without most careful consideration; and

"Whereas, in our opinion, proper consideration of such important changes as are proposed can be had only by an unbiased, non-partisan commission, made up of men from various walks of life and not from any one vocation or interest,

"Be it resolved, That the American Institute of Electrical Engineers, acting through its officers and board of directors, respectfully urges the Congress of the United States that ilt provide for a commission made up of unbiased, independent, non-partisan men of such national standing as will command the respect of the whole country and chosen from different walks of life, and not more than one from any one calling or interest, and serving without pay; such commission to hold public hearings, and otherwise, as may appear to it best, to make a thorough and careful study of the American patent situation, and to prepare and submit a comprehensive report and recommendations to Congress for such changes, if any, as may, as the result of its study, appear to it expedient, whether in the Patent Office, in the method of court procedure or in the organic patent law, and recommendations as to the legislation it would propose for effecting said changes; and that we further respectfully urge that the Congress make ample provision for the expenses of said commission; and

"Be it resolved, That we respectfully urge the Congress of the United States to hold in abeyance all proposed legislation affecting the patent system in whatsoever way until such time as the said commission shall have had ample opportunity to hold the said hearings and make the said study and report; and

"Be it further resolved, That these resolutions be printed and a copy be sent to each Senator and Representative of the United States who is a member of the Senate or House committee on patents."

MEDINAH TEMPLE, CHICAGO, WHERE N. E. L. A. CONVENTION WILL BE HELD.

As this issue of the *Electrical World* goes to press it seems to be practically decided that next year's convention of the National Electric Light Association in Chicago will be held in the new Medinah Temple, on the North Side, during the first week in June. This building is of recent

Fig. 1—Exterior of New Medinah Temple, Chicago.

construction and is not to be confounded with one at the corner of West Jackson Boulevard and South Fifth Avenue, in the central business district, which has borne the same name. It was erected for the Nobles of the Mystic Shrine and appears to be well adapted for the purposes of a great convention such as that of the National Electric Light Association. Its large auditorium seats 5200 people comfortably, and its check room, reception room, lobbies and other facilities are similarly gaged to handle a throng of this size with ease. Beneath the main auditorium is a dining hall, 250 ft. by 120 ft., which will be used to advantage for manufacturers' exhibits.

Occupying nearly a full city block, with frontage on Ohio, Cass and Ontario Streets, the building is within easy walking distance of the City Hall and is also reached conveniently by frequent street cars on the North State Street line. The exterior suggests Moorish architecture, with characteristic arabesque decorations, and is attractive.

Fig. 2—View of Main Auditorium, Medinah Temple.

Exclusive of the curtained section of the stage behind the proscenium arch, the main auditorium measures 120 ft. by 214 ft. in plan and is 76 ft. high from the floor to the peak of the central dome. A large part of the main floor is occupied by a raised stage, 70 ft. by 70 ft., which will accommodate 1000 chairs, in addition to the 4200 permanent leather-upholstered seats on the three levels, main floor, balcony and gallery. The arrangement of the seats is that of a great semi-circle about the stage, and the acoustic qualities are excellent, so much so that a speaker using ordinary conversational tones from the rostrum can be heard distinctly from any seat in the auditorium, despite its large size. Each level is supplied with numerous exits which open on soundproof passages extending around the building outside the auditorium. Iced water, pumped, filtered and refrigerated by electricity, is circulated to drinking fountains near the various exits. Reception, smoking and toilet rooms are also at hand within a few feet of every exit on all three levels.

A flat gilded dome, 50 ft. in diameter and rising to 75 ft. above the floor of the auditorium, forms the central ceiling design. From it depends a huge direct-indirect lighting fixture carrying nearly 200 tungsten lamps, most of which are concealed in reflectors and light the room by diffused reflection from the ceiling. Smaller direct-indirect fixtures light smaller domes at the sides, and the ceiling panels are marked by tungsten clusters. A complete switchboard and dimmer equipment controls the 6000 house and stage lamps. Plug outlets along the border of the projecting stage provide for the connection of foot-lamps. There is also a permanent foot-lamp trough beneath the proscenium. A narrow trap-door is lifted back, and by means of a lever the foot-lamp reflectors can be swung up into place.

The Commonwealth Edison Company supplies electrical energy for the Temple. Low-pressure steam boilers are operated for heating the building. Motor-driven blowers provide ventilation, supplying 161,000 cu. ft. of air per minute. Messrs. Huehl & Schmid, Chicago, were the architects, and W. H. Brown & Company, also of Chicago, installed the electrical equipment.

PUBLIC SERVICE COMMISSIONER MALTBIE ADDRESSES NEW YORK EDISON EMPLOYEES.

Many of the New York Edison Company's executive officers and more than 400 of its employees of both sexes were present in the company's auditorium at 4 p. m. on Dec. 4 to hear the Hon. Milo R. Maltbie, of the Public Service Commission for the First New York District, speak on "Public Service and the Public." This address was one of a series of addresses to be made on important topics during December and January by prominent men in various fields to the employees of the company enrolled in its commercial courses.

Commissioner Maltbie's remarks concerned the necessity for the existence of public-service commissions and the benefits that are enjoyed by public-service corporations and their patrons through regulation. He distinguished between the non-restricted methods upon which a private business may be conducted and the necessary limits which must be imposed in the operation of a public-service corporation so that the business of the latter shall be carried on with fairness to it and to its customers.

A public-service corporation, unlike a private concern, must furnish adequate service, he said, at all times at reasonable rates and in a fair and impartial manner to all persons who agree to comply with its regulations. There is an obvious need in a community for the existence of an authority to say what rates shall be just. The whole tendency of the electric-light industry since its origin, he said, has been to reduce competition, and consolidation and unification of ownership and management have been the result of this trend. While, he said, elimination of competition has not been a characteristic of the central-station industry alone, yet in that field, generally speaking, it has gone farther than it has in many other lines of business. In view of this, the speaker said, and of the universal trait of human nature to raise prices when in control of a

monopoly, one of the principal reasons warranting the creation of public-service boards is apparent. The benefits of having an arbiter by whom differences between a company and its customers can be amicably adjusted, the protection afforded security holders by public-service regulation and the satisfaction accruing to both company and customers from meter tests made by the commission upon complaint to it were among other subjects touched upon by the speaker.

Mr. Arthur Williams, general inspector of the New York Edison Company, offered three prizes in gold, of $15, $10 and $5 respectively, for the best papers written by employees, based upon the address.

Mr. John W. Lieb, Jr., third vice-president of the company, in introducing Mr. Maltbie, spoke of the discernment and judgment which had been shown by Associate Justice Hughes of the Supreme Court of the United States when, as Governor of New York, he selected the members of the original commissions in the two districts of that State.

WESTERN MEETING OF AMERICAN PHYSICAL SOCIETY.

The Western meeting of the American Physical Society for 1913 was held on Nov. 30 in the physical laboratory of Northwestern University, Evanston, Ill. Dr. Henry Crew, professor of physics at Northwestern University, presided and Prof. Ernest Merritt, of Cornell University, performed his duties as secretary. Twenty-two papers were presented and nearly all of them were discussed. The papers relating more directly to electrical science may be mentioned as follows: "The Value of *e* (elementary electric charge)," by Prof. R. A. Millikan, University of Chicago; "Note on the Distribution of Velocities of Photo Electrons from Thin Cathode Films When Illuminated by the Mercury Arc," by Profs. Paul H. Dike and F. C. Brown, University of Iowa; "New and Old Expressions for the Variation of the Mass of the Electron with Increasing Velocity," by Prof. Jakob Kunz, University of Iowa; "The Relation Between Current and Time Rate of Change of Electric Force," by Prof. Max Mason, University of Wisconsin; "The Stability of Residual Magnetism," by Prof. N. H. Williams, University of Michigan; "The Effect Upon the Elastic Properties of Copper Wire Produced by Increase of Temperature and Passage of an Electric Current," by Prof. H. L. Dodge, University of Iowa; "A Method of Producing Light-Negative Selenium," by Prof. F. C. Brown, University of Iowa; "The Cause of the Apparent Differences Between Arc and Spark Sources of Light in the Imparting of Initial Speeds to Photo Electrons," by Prof. R. A. Millikan.

PROSPECTS OF PATENT LEGISLATION.

Representative Oldfield, of Arkansas, chairman of the House committee on patents, expects to make a vigorous effort to have the bill known as the Oldfield patent bill, which has already been favorably reported by his committee, passed by the House of Representatives at this session. In all probability he will ask for a special rule to bring the bill before the House. This will be necessary in view of the fact that the patent committee was called, under the call of committees, just before the last session of this Congress adjourned and will probably not be reached again at this session. Representative Oldfield expects to ask for this rule shortly after Jan. 1, and if no objection to granting it is made by the leaders of the House the bill will come up shortly thereafter.

Representative Oldfield is of the opinion that the bill stands a good chance of passage at this session. He has discussed it with Speaker Clark, Representative Underwood, chairman of the ways and means committee, and other leaders of the House, and he is encouraged by their attitude.

In some quarters in Washington, however, there is a tendency to believe that there is little prospect of legislation at this short session of Congress on other than appropriation measures. It will be necessary to pass these large supply bills in the short space of three months, and they are greater this session than they have ever been before, aggregating $823,315,455. It is quite certain that the members of the present Congress, many of whom will not return after the expiration of the present Congress on March 4, would not be willing to allow any of the appropriation measures to be handled by their successors even if they could do so. The Interior Department asks for approximately $25,000,000 more than it had in the last appropriation, the War Department for $10,000,000 more and the Navy Department for $24,000,000 more. These large increases mean that these bills will occupy more time in the House than they did at the last session, and there is no way of prolonging the session after March 4.

There is, therefore, a possibility that the patent bill will not be reached at this session, a fate that will be shared by hundreds of other measures for general legislation. In this case, it will more than likely go over until next year, as it is extremely improbable that it will be taken up at the extra session of Congress which is to be called by President-elect Wilson for the purpose of revising the tariff.

Nevertheless, Representative Oldfield will ask for the special rule to bring the bill before the House, and he is of the opinion that if he can get it on the floor it will easily pass, as he is convinced that a majority of the House favor it. No further hearings will be held in regard to the bill, nor are there likely to be any hearings on any patent subject before the House committee this winter. Representative Oldfield is of the opinion that no alterations need be made in the bill because of the decision of the Supreme Court in the so-called "Bathtub" case, and he will try to bring the bill up as it is.

ELECTRIC TRANSPORTATION DISCUSSED AT BOSTON.

At the regular weekly gathering of the Luncheon Club branch of the New England N. E. L. A. Section in Boston on Nov. 22 an illustrated lecture was given by Mr. Henry C. Long, of Boston, on "Terminal Electrification in Large Cities." The speaker advocated state ownership of docks and railroad terminals as a preliminary to complete electrification, and devoted about an hour to the discussion of lantern slides illustrating the uses of electricity in modern freight and merchandise handling, emphasizing the application of motor hoists, traveling floors and cranes, belt conveyors and elevators in warehouses, the opportunity for the electric truck in eliminating street congestion and raising the efficiency of terminal service, and the great advances lately made in various parts of the world in the loading and unloading of vessels by motor-driven equipment. A single warehouse at Newark, N. J., is 1000 ft. long and is equipped with fourteen electric elevators, elaborate belt conveyors and a movable floor system, all electrically operated. Sixty-four freight cars can be unloaded at once on the second floor. Among the illustrations were several showing electrically driven belt conveyors on docks in Australian cities, fruit-handling apparatus at New Orleans, aerial cranes at Duluth, Minn., and modern dock equipment at Hamburg, Germany; Liverpool, England, and other foreign ports. A four-track, electrically operated belt-line railroad for Boston passenger and freight service was advocated, and terminal improvements in prospect by electrical methods at Buffalo, N. Y., were outlined.

THE VALUE OF THE ELEMENTARY ELECTRIC CHARGE.

From the viewpoint of those interested in electrical science no doubt the most interesting and important paper read at the meeting of the American Physical Society in Evanston, Ill., on Nov. 30 was that on "The Value of the Elementary Electric Charge," by Dr. R. A. Millikan, professor of physics in the University of Chicago. Dr. Millikan's demonstration of the ionic theory by the behavior of droplets of oil in air when subjected to electric forces has attracted wide attention. The present paper gives a report of the results of the redetermination of all the factors that enter into the evaluation of the elementary electric charge by the oil-drop method. The chief modification of the method consists in working at all pressures between 2 cm and 76 cm of mercury in order to get an accurate value of the correction term to Stokes' law. The final result was: $e = 4.774 \times 10^{-10}$ absolute electrostatic units, e standing for elementary electric charge. The probable error is not more than 0.2 per cent.

In order to get the value of e it was necessary to determine the law of the fall of the drop through air when the mean free path of the molecule is of the same order of magnitude as the diameter of the drop. This law is given by the empirical equation

$$X = 6\pi\mu a v\left(1 + \frac{l}{a}\left\{0.874 + 0.35\,\varepsilon^{-\frac{1.7a}{l}}\right\}\right)^{-1}$$

where X = force in dynes acting on the drop,
ε = the Napierian base,
μ = the coefficient of viscosity of air,
l = the mean free path of the gas molecule,
a = the radius of the drop, and
v = the velocity with which it moves.

This equation holds down to $\frac{l}{a} = 4$. Beyond this point the observations have not been carried as yet. It will be seen from this equation that for values of $\frac{l}{a} > 0.4$ the equation takes the simpler form

$$X = 6\pi\mu a v\left(1 + 0.874\,\frac{l}{a}\right)^{-1}.$$

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC.

The committee appointed at the conference of central-station jobbing, contracting and manufacturing interests at Association Island, New York, on Sept. 3 to arrange for the organization of a society or association to carry on co-operative work for the benefit of the entire electrical industry held its fourth meeting on Dec. 2 in the Engineering Societies Building, New York. As our readers will recall, the Society for Electrical Development, Inc., was incorporated under New York laws on Nov. 13, through the efforts of this committee, to establish co-operative relations among the different electrical interests in the United States, Canada and Mexico, and for the purpose of increasing the use of electrical energy by the public. At the meeting on Dec. 2 a sub-committee on finance and administration to carry out additional plans was appointed. Sufficient funds to carry on the work were advanced by members of the organization committee. Much progress has been made in the development of a practical plan for accomplishing the purpose of the society, but there is yet a vast amount of detail work to be done by the committee before the latter will have its suggestions in a form to place before the industry at large. The next meeting will be held either in the latter part of this month or early in January.

CO-OPERATION IN PHILADELPHIA.

Beginning with bi-monthly meetings of the inspectors of the Philadelphia Fire Underwriters' Association, initiated several years ago, an informal co-operative movement is making considerable headway in Philadelphia under the guidance of Mr. Washington Devereux, chief of the electrical department of the Underwriters' Association.

A few months ago the inspectors and district managers of the Philadelphia Electric Company were invited to attend the association meetings. Invitations were also extended to city inspectors, electrical contractors and their superintendents and foremen. All are now meeting together twice a month to discuss the code, city regulations, the best methods of co-operation between various branches of the industry and how they can most effectively join in plans for increasing business. A question box is provided and subjects thus brought up are passed upon by a sub-committee, whose reports are regularly presented at the meetings. One result of these electrical conferences is a marked improvement in methods of installation, due to a better understanding not only of the requirements of the code but also of the reasons for the various rules.

STORAGE-BATTERY DISCUSSION AT CHICAGO.

Storage batteries of both the lead and nickel-iron types were the topics before the joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, held in the latter's rooms, Monadnock Block, Chicago, Nov. 25.

With Mr. Ernest Lunn, battery engineer for the Commonwealth Edison Company, presiding, the program was opened by Mr. J. L. Woodbridge, Electric Storage Battery Company, Philadelphia, Pa., with a paper entitled "Economic Applications of the Storage Battery." After pointing out that the storage battery is the only electrical device whose output is taken at times and at rates differing from those at which its input is taken, Mr. Woodbridge described and illustrated methods of cell control by means of the carbon-disk regulator, the average-load adjuster and circuits for securing constant net charge. While American central-station practice usually limits battery applications to stand-by service, electric railways in this country have found batteries profitable investments for reducing their peak-load costs.

After a description of methods of manufacture of the Edison nickel-iron battery, Mr. H. H. Smith, Edison Laboratory, East Orange, N. J., directed attention to some of the interesting characteristics of the alkaline-type cells, particularly their ability to withstand careless handling and charging, high rates of input, etc. At internal cell temperatures below 40 deg. Fahr. the active material of the nickel-iron battery becomes dormant, said Mr. Smith, but with proper protection and handling there is no good reason why the battery itself should ever be chilled below normal operating temperatures. A car-lighting set on an Illinois Central Railway car was, for example, operated two weeks during weather ranging from 32 deg. to 42 deg. below zero, as shown by a recording thermometer. The lowest temperature reached inside the battery boxing was 8 deg. below zero, but the battery showed no diminution of output. Finally the train was caught in a snowdrift and the cells delivered their full rated output while the cars were stalled. Electric trucks with Edison batteries are employed successfully at Winnipeg, Manitoba, despite temperatures 44 deg. below zero, and these trucks, according to their owners, are fully satisfactory under all weather conditions. Nickel-iron cells have energy outputs of 13 to 16 watt-hours per pound of weight, in comparison with lead cells at about 10 watt-hours per pound. An exchange plan

for automobile lighting batteries is now being introduced, with exchange stations in the principal cities. Edison cells have also found an important use in connection with the heavy ordinance of the United States Army, the immunity of the cells against concussion and fumes particularly fitting them for this purpose.

In the discussion Mr. T. Milton, Chicago, called attention to the effect of the internal resistance of the Edison battery in reducing short-circuit currents to about sixteen times the normal output. Lead cells when short-circuited deliver currents forty to sixty times the normal output, he said. Mr. D. McCrae, Chicago, referred to the value of battery installations for central-station stand-by use. Others who took part in the discussion were Messrs. Godfrey Atkins, F. F. Schuchardt, E. H. Freeman, W. Beck, R. H. Rice, G. W. Cravens and Albert Scheible.

REDUCTION OF FIRE RISK BY ELECTRICAL INSPECTION.

At the regular bi-weekly Jovian luncheon held at the Hotel Imperial, New York, on Dec. 4, Mr. Frank E. Watts, reigning Jupiter, who presided in the absence of Statesman Joseph F. Becker, introduced as the speaker of the day Mr. William H. Merrill, manager of the Underwriters' Laboratories, Chicago, whose topic was "The Basis for General Co-operation." Mr. Merrill stated by way of introduction that his remarks would be along the same general lines as those he had previously made before the electrical jobbers' and manufacturers' associations.

The annual fire loss in America is approximately $250,000,000. This tremendous sum represents a total waste and is an enormous tax on the American people. In proportion to our population it is much higher than the losses sustained abroad. The annual loss per capita in this country Mr. Merrill gave as $2.47, which compares with 30 cents to 34 cents per capita in Europe. But the heavy loss of life is a still more serious consideration. The speaker referred to many of the great disasters, such as the Iroquois fire in Chicago, the Slocum disaster in New York and others. These horrors, he said, are soon forgotten by the general public because of the frequency with which such holocausts occur.

The National Board of Fire Underwriters maintains a corps of experienced engineers who go from city to city investigating fires and their causes and making recommendations for diminishing the probability of such losses in the future. Mr. Merrill briefly described the functions of the Underwriters' Laboratories in Chicago and the branch maintained in New York City. Carelessness, he said, is the greatest factor in fire waste and often extends beyond the user or owner to the contractor, sometimes to the jobber, and even in some cases to the manufacturer. He referred to the great success of the National Electrical Code, declaring it to be the most universally used engineering specification in existence. Nevertheless, declared Mr. Merrill, it is not by any means used to the extent to which it ought to be used, particularly in the smaller places and outlying communities. In these thinly populated districts the insurance companies cannot afford, as a matter of economy, to enforce the code, and in some parts of the country they are even restricted by state laws from making joint inspections with the local authorities. He expressed himself, nevertheless, in favor of both municipal and state inspection.

Since the members of the Jovian Order are so generally representative of the industry, they are in a position, in Mr. Merrill's judgment, to exert much influence for the universal enforcement of the code. In concluding his remarks the speaker emphasized the need of uniform national rules and requirements, in place of the non-uniformity now existent and the lax enforcement in many districts. The safety to life and property is the great consideration to be kept always in mind.

A vote of thanks was tendered the speaker for his remarks, and local representatives of the Underwriters were offered a standing invitation to attend the Jovian luncheons and keep the members informed in reference to the progress made in obtaining more strict inspection and better general enforcement of rules and regulations intended to diminish fire waste. The attention of the members was again drawn to the "rejuvenation" which will be held at Healy's Restaurant, New York City, on the evening of Dec. 16.

MEETING OF NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS.

The twenty-fourth annual meeting of the National Association of Railway Commissioners, which recently convened in the city of Washington, D. C., was briefly referred to in our issue of Nov. 23. The reports of nineteen different committees were received and discussed at length, but most of these had to do with the regulation of steam railroads.

An interesting report was presented on the subject of railroad taxes and plans for ascertaining fair valuation of railroad property, in connection with which the discussion of methods of valuation was drawn out to considerable length. Methods employed in various states were taken up and many differences were noted. There was considerable discussion of the percentage allowance to be added to physical property for such items as engineering and supervision, legal and general expenses, interest during construction, contingencies and "going concern" value.

The report of the committee on rates and rate-making was confined practically to the subject of freight rates and did not touch except in a broad way upon the problems involved in fixing rates for public utilities. In discussing the methods of valuing railway properties, Commissioner Eshleman, of the California Railroad Commission, made the following interesting statement: "But you will find out that almost every fallacy that has found its way into a court decision concerning valuation is the result of the testimony of an engineer on things that are not engineering questions. In our commission we have the greatest confidence in our engineers, but we try to limit them to the discussion of those physical things that engineers know about."

On the second day of the convention Prof. John H. Gray, of the University of Minnesota, explained to the assemblage the work which he has undertaken for the National Civic Federation in compiling and analyzing the public-utility regulation laws of the United States. A large staff has been at work under Professor Gray's direction, and it is hoped to have the complete compilation ready for distribution early next year. The report of the committee on rails and equipment, having special reference to rail failures, took up much of the time of the third day's sesssion.

On the fourth day the report of the committee on telephone and telegraph rates and service came up for consideration, and a brief abstract of it follows. The whole telephone art has been developed to its present state of perfection since 1876, and the United States leads all other nations in telephone development, 70 per cent of all the telephones of the world being in use in this country. The vital question of competition in the telephone business was taken up for extended consideration. As it has existed in the past, competition has not been an unmixed blessing nor has it brought about the beneficial results which its advocates have prophesied. On the other hand, legitimate competition has helped enormously to extend the use of the telephone, has been an excellent school of experience and has, no doubt, in most cases had the effect of keeping rates within bounds. During the course of the rapid commer-

cial development there were many instances of abuse in promoting new schemes and promising enormous profits which were seldom realized. The outcome has been for the most part a serious disappointment and an economic waste in the unnecessary duplication of service, which approximates $10,000,000 per annum. The report raised the question as to whether competition in the telephone business has not already served its useful purpose and whether regulated monopoly is not now desirable in the interest of economy and efficiency. In relation to rates, the report states that they have not been built up on any hard and fast rules or strictly scientific cost basis but rather have been the outgrowth of adjustments which in the judgment of the companies gave promise of the best results for the expansion of the business. The committee considers that there are many unsolved problems in analyzing the cost of telephone service and distributing the charges equitably among consumers of different classes. Mention was made of the difficulty of segregating exchange plant from toll plant and also distributing operating costs between these two divisions of service.

The telegraph service of the country has recently been extended by the close relationship created between some of the principal telegraph and telephone companies and by the establishment of joint rates for combined service. In respect to methods of accounting, the report called attention to the system proposed by the Interstate Commerce Commission and described in its Accounting Circular No. 30. The desirability of making some changes in the proposed classifications under the Interstate Commerce system was brought up for consideration. Commissioner Watson, of Oklahoma, discussed the report briefly and stated that the Oklahoma Corporation Commission has devoted its energies wherever possible to preventing the establishment of two telephone systems in the same city or town. That commission has also had occasion to establish rates for telephone service and has found it necessary to make complete valuations of the telephone companies' property. Many of the problems arising in fixing telephone rates have not yet been solved to the satisfaction of the Oklahoma commission.

The following officers were elected for the ensuing year: President, Hon. O. P. Gothlin, of Ohio; first vice-president, Hon. L. B. Finn, of Kentucky; second vice-president, Hon. Clifford Thorne, of Iowa; secretary, Mr. W. H. Connolly, of Washington, D. C., and assistant secretary, Mr. William Killpatrick, of Illinois.

COURT DECISION IN RELATION TO CENTRAL-STATION COMPETITION AT LOUISVILLE, KY.

In overruling the demurrers filed by the Kentucky Electric Company and the Louisville Lighting Company, Judge Kirby, of the Circuit Court, rendered a decision which prevents the Kentucky Electric Company from selling its franchise, plant or capital stock to the Louisville Lighting Company, the Louisville Gas Company, H. M. Byllesby & Company or any other competing company or interest. The suit was filed by the city of Louisville last June for the purpose of enjoining the Kentucky Electric Company from selling out to the other interests mentioned above. Had such a sale taken place, competition in the central-station business in Louisville would have been entirely removed. It was charged in the petition filed by the city that the Kentucky Electric Company was seeking to sell its franchise and other property to the defendants for the sum of $3,000,000. The following broad principle laid down by Judge Kirby in the decision will interest all stockholders in public-utility enterprises:

"That a stockholder may go upon the market and sell his stock in the ordinary course of trade cannot be denied; but conspiring and confederating for the purpose of doing that which is denied by an ordinance can and should be enjoined. While it is true that at common law the shareholder's identity is separate from that of the corporation, a court of equity has always looked to the substance and not to the form and in a proper case will control a corporation through its shareholders, as well as by any other means. The establishment of a monopoly, with the consequent oppression, is abhorrent to society and the law, and a court of equity will look beyond a fiction in order to enforce a contract designed to prevent a monopoly."

UTILIZATION OF ELECTRIC IRONS.

The use of small electric heating devices has grown to such an extent as to form a most important factor in the business of the manufacturer as well as the central station. The electric flatiron in particular has become a very popular utensil and is not to-day looked upon as a luxury but as a time-saving and labor-saving device available for any family. Progress in the sale of irons and the building up of most extraordinary load curves due to such sales have been reported in these columns in regard to a number of individual central stations.

There are cases such as at Altoona, Pa. (*Electrical World*, Oct. 7, 1911), where the load on Tuesday forenoon exceeds that of the evening of the same day by 20 per cent and where the load is practically even from 8 a. m. to 9 p. m. The matter has been the subject of much discussion at the meetings of electrical societies and much has been written in technical journals in regard to ways and means for securing such an off-peak load. The most effective inducement has probably been the free-trial offer, which has seldom failed to procure a permanent user of the iron. The price of an electric iron has often been the principal obstacle to overcome until the prospective customer has had an opportunity to form a closer acquaintance with the advantages it offers.

With the object of analyzing the general situation in regard to the flatiron, information has been secured from a number of representative central stations, a total of 491, in regard to the percentage of residence customers furnished with electric irons by the central stations, the price at which they are sold, the percentage of irons sold on the free-trial basis and the difficulties encountered in placing irons.

The tables in this article are not arranged to show actual number of sales under various conditions of price and free-trial offers, but rather to indicate the average of the percentages reported in each particular group. Each station is treated as a unit in regard to sales and the figures give the averages of the total number of units. By this method of representing the subject it is believed the reader will obtain a clearer conception as to the average condition under which irons are sold than if the actual number of sales were reported in each particular case.

Referring to Table I, it will be noticed that the central stations have been divided up in seven groups according to population served. In regard to the first group it may be said that the number of irons used varies greatly, owing to the fact that small communities differ very much as to the average income of the population, some being, for instance, mining centers, where only a small percentage of the residence customers are furnished with irons, while on the other hand in a number of suburban and other communities with a well-to-do population up to 95 per cent of the residence customers use electric irons. In groups 2, 3 and 4 it is fairly safe to state that the average comes very close to the number in actual use, while in groups 5, 6 and 7 the figure represents merely the average number furnished by the central stations. In cities represented in these groups

there are always a number of supply dealers selling irons which the central station has no means of recording and which in many cases would increase the averages to figures equal to those of the other groups.

The average percentage sold on free trial does not show the variation that might be expected. In smaller communities it is undoubtedly a good deal easier to apply this method, and it is also accompanied with considerable less risk. The selling price in the larger cities is higher than in small towns. Even the small towns, however, show an average selling price of 18 per cent above cost, which just about corresponds to the manufacturer's list price. By far the larger percentage of central stations expect to retain the present prices during 1913. In all groups the tendency seems to be rather to decrease the price than to increase it. To what extent this will influence the sale of irons is doubtful, as it is shown in Table II that the price does not materially affect the sale. In fact, central stations selling at 35 per cent or more above cost have had the largest average sales.

TABLE I.—AVERAGE SALES OF FLATIRONS PER CENTRAL STATION GROUPED ACCORDING TO POPULATION OF TOWNS SERVED.

Group.	Number of Stations Reporting.	Population.	Average of Percentages of Customers per Station Furnished with Irons.	Average of Percentages Sold on Free Trial.	Average of Percentages Added to Cost.	Changes in Price for 1913. Percentage of Total Number of Stations Reporting.		
						Decrease.	Equal.	Increase.
1	159	0–2,000	44	58	18	12	79	9
2	151	2,000–5,000	54	57	18	19	74	7
3	87	5,000–10,000	54	65	21	15	80	5
4	45	10,000–20,000	56	51	26	15	74	11
5	31	20,000–50,000	49	52	19	10	80	10
6	6	50,000–100,000	37	54	25	17	66	17
7	12	100,000 up	37	55	33	33	67	..

As noted above, the manufacturers' list price is between 15 per cent and 20 per cent above cost price, and this seems for various reasons to be the most logical selling price. In fact, the table shows that as a whole the largest number of sales are made at this price. One reason which should not be overlooked, being of very great importance, is that in this way the central stations will not be competing with the supply dealers but working on a co-operative basis, which is believed to be of greater ultimate advantage to both parties. It also leaves an ample margin for the expenses of soliciting and local advertising.

TABLE II.—RELATION BETWEEN SELLING PRICE AND PERCENTAGE OF RESIDENCE CUSTOMERS FURNISHED WITH IRONS.

Percentage Added to Cost.	Percentage of Total Number of Central Stations Reporting.	Average of Percentages of Customers per Station Furnished with Irons.
0–5	10	49
6–10	16	47
11–15	15	49
16–20	20	50
21–25	19	47
26–30	9	47
31–35	5	58
36 up	6	64

Table III shows conclusively the effect of the free-trial privilege. The percentage of stations applying this method shows that its advantages are well appreciated. The difference in sales between the group not allowing free trials and those availing themselves of this opportunity to its full extent is 9 per cent. In order to illustrate the importance of such a difference, take, for example, a station having, say, 2000 residence customers. With an average annual consumption of 83 kw-hr. per iron, which is a very conservative estimate, the total consumption of 9 per cent, or 180 irons, would make 14,940 kw-hr. Sold at 10 cents per kw-hr. this would mean an income of $1,490 for off-peak service.

The difficulties in selling electric irons may be summed up as lack of education as to the cost of operation and general advantages of the electric iron. There is a fear on the part of the users that the bills will be run up exorbitantly through the use of an electric iron. Admitting that the cost of operation is high when energy is sold at 20 cents per kw-hr., even at that rate irons are sold and used where the consumers have been properly educated as to the iron's advantages. In a Western city selling energy at 20 cents per kw-hr. 60 per cent of the consumers have bought irons from the central station and not one has been sold on the free-trial basis. Demonstrations and local advertising by the central stations, in combination with the free-trial offer, have proved to be the most effective means. One central station reports that after some advance advertising and a few days' demonstration at the central station office a canvass of the town was made, in which 40 per cent of the total residence customers were furnished with irons. Through subsequent canvasses the number of users has been brought up to 90 per cent of the total. Forty per cent of the sales were made on the free-trial basis and all irons were sold at 35 per cent above cost. This forms a very striking example of what can be accomplished by educating the public. There are a great number of similar cases, besides instances where some particular difficulty has to be overcome, such as competition with natural gas sold at 22 or 23 cents per 1000 cu. ft., where equally good results were obtained by the same means.

TABLE III.—RELATION BETWEEN FREE-TRIAL SALES AND PERCENTAGE OF RESIDENCE CUSTOMERS PER CENTRAL STATION FURNISHED WITH IRONS.

Percentage Sold on Free Trial.	Percentage of Total Number of Stations Reporting.	Average of Percentages of Customers per Station Furnished with Irons.
0	12	45
1–25	13	49
26–50	20	47
51–75	21	53
76–100	34	54

Again referring to Table I, it should be called to the reader's attention that of the group of stations serving a population up to 2000 10 per cent give day service during only one day of the week or have no day service at all. It is remarkable to note that several stations with only one day for ironing have sold irons to from 50 to 75 per cent of their customers. In some places in the South with no day service from 25 per cent to 50 per cent of the customers use electric irons. Among other remarkable instances may be mentioned one central station in Minnesota, serving a population of 7000, with 680 residence customers, where 750 irons have been sold. A station in Indiana serving a population of 4150, with about 600 customers and no day service, has nearly 200 irons in use. A station in Missouri serving a population of 6300 has furnished very nearly all of its residence customers with irons and has given them away to the remainder of its customers, so that now all of

its customers have irons. In this case 70 per cent were sold on the free-trial basis and all irons were sold at 33 per cent above cost.

It has been remarked in a number of instances that the gossip among housewives plays an important part in regard to the eventual success of a flatiron campaign, particularly in smaller communities. If a customer has an iron which is giving satisfaction in every respect, the neighbors will hear about it, and this will help to stimulate the desire to own one just as much as a good deal of advertising and demonstrating. Any trouble with the iron will spread as rapidly through the same channels. It is therefore of very great importance that the central station and the supply dealer keep in stock an iron of reliable make and one with which the salesman feels that he can give a positive guarantee. The consumers do not know the different makes of irons, and it is shown that in 90 per cent of inquiries by intending purchasers this is left entirely to the salesman or his advice is asked in regard to which make of iron is best. Trouble experienced with cords and terminals has considerably discouraged prospective buyers. A careful consideration on the part of the central-station manager as to the make of iron to carry will undoubtedly show its effects on the sales records.

STREET-LIGHTING TABLES.

With the present issue will be found, in the form of a supplement, our annual street-lighting schedules, which have been prepared in conformity with a plan followed continuously since 1890, when the schedule devised by Mr. W. H. Frund was first published.

The data in Table No. 1 have been compiled in such a manner that by following this schedule the lamps are lighted one-half hour after sunset and are extinguished one hour before sunrise, giving a yearly operation of about 3830 hours. An "all-night" lighting schedule, giving a yearly total of about 4000 hours, could be obtained by lighting fifteen minutes earlier and extinguishing fifteen minutes later than shown in this table.

In the so-called "Philadelphia Moonlight Schedule" (Table No. 2), beginning the fourth night after new moon advantage is taken of the moonlight, and on nights when the moon is full or nearly so the lamps are not lighted. On other moonlight nights the lamps are extinguished one hour after moonrise and lighted one hour before moonset. With this schedule the lamps are in operation about 2000 hours per year.

Table 3 is calculated according to the system of Mr. Frund and ignores the moon until after midnight throughout the year. The lighting hours after midnight are the same as those in Table No. 1, except that the lamps are not used during the period of full moon. This schedule entails the use of lamps for about 3000 hours per year.

All of the tables are based on mean local time and were calculated for latitude 40 deg. north. They may be considered as correct within ten minutes for any place in New York, Connecticut, Pennsylvania, Rhode Island, New Jersey, Ohio, Indiana, Illinois, Iowa, Delaware, Maryland, Virginia, West Virginia, Kentucky, Missouri, Kansas, Nebraska, Utah, Colorado, Nevada and northern California. They may also be considered correct within ten minutes for all places within the United States proper during the months of March, April, September and October. The maximum correction factor should be applied in June, when the nights are shorter in the Northern than in the Southern States, and in December, when the reverse is the case. During these months the disagreement along the northern borders of the United States and as far south as Charleston, Birmingham and Los Angeles will not exceed twenty minutes. A maximum correction factor of one-half hour may be assumed for Jacksonville, Fla., and Houston, Tex.

THE HETCH HETCHY WATER AND POWER PROJECT FOR SAN FRANCISCO.

San Francisco, in common with nearly all large centers of population in this country, is engaged with the problem of conserving for the future an adequate supply of water for domestic and public uses. The city authorities have recently filed with the Secretary of the Interior a 400-page report, prepared by the well-known expert on water supply, Mr. John R. Freeman, and a staff of expert assistants, describing a gigantic water-supply project, which, when fully developed, will care for San Francisco's needs for many years. This report is the result of two years' personal study of the problem on the part of Mr. Freeman and his staff. The needs not only of San Francisco, but of some twenty-six neighboring municipalities, all comprising a proposed metropolitan water district, have been considered as a unit.

It is proposed to make use of portions of the Hetch Hetchy, Eleanor and Cherry Creek Valleys within and near to the boundaries of the Stanislaus United States National Forest Reservation and the Yosemite National Park, and the watersheds which are tributary to these valleys and the Tuolumme River, situated about 150 miles directly east of San Francisco at the base of the Sierra Nevada Mountains.

While the city of San Francisco now owns in fee simple much of the mountainous territory which is necessary to the accomplishment of this huge water-supply project, the titles to the many steep, rocky slopes, one of the dam sites and portions of the valleys remain with the United States. Therefore the development of this project comes under the regulation of the federal authorities. Aside from its bold and interesting features as a water-supply undertaking, a large hydroelectric development is involved, which, when ultimately completed, will produce an estimated total of 157,000 mechanical hp for high-tension transmission to distant markets.

The city proposes to build a masonry reservoir dam about 300 ft. in height above the riverbed in the narrow gorge at the outlet of the Hetch Hetchy Valley, by which the water can be raised about 270 ft. above the nearly level floor of the valley. An aqueduct will be constructed from this reservoir to the city of San Francisco, largely in the form of a tunnel about 10 ft. in finished diameter, mostly deep beneath the surface of the ground. The proposed aqueduct between the Hetch Hetchy and the Irvington gatehouse on the hillside overlooking San Francisco Bay is designed to deliver, by force of gravity, without pumping, a quantity of water somewhat in excess of 400,000,000 gal. daily, and under extreme conditions possibly 500,000,000 gal. per day. The communities to be supplied will require in the immediate future for domestic and municipal purposes but a small fraction of the quantity of water which can be transmitted by the ultimate development, and according to present plans some of the surplus will be made available, at a moderate meter rate, for irrigation, principally in connection with intensive farming and truck gardening in the San Francisco district.

The portion of tunnel about 12 miles in length next down stream from the Hetch Hetchy dam will be delayed in construction for some years, and meanwhile the city proposes to divert the water from the main Tuolumne River by means of a temporary dam at a point about 1½ miles upstream from the confluence with Cherry Creek. Tributary reservoirs will ultimately be created at two sites, one at Lake Eleanor and the other at Cherry Creek, discharging into the Hetch Hetchy through an 8-ft. underground tunnel.

The city does not propose in the immediate future to construct any plant for the development of hydroelectric power, but plans to conserve carefully all reasonable opportunities for power development against the time when it may become expedient to undertake such developments.

The aqueduct will be built with surge shafts, inclined tunnels and appurtenances suitable for the attachment of turbine penstocks and with forebays for receiving water from the tailraces of future turbines. By this means the only added cost for power development will be substantially that of the power houses and their foundations, the hydraulic and electric machinery, auxiliary equipment and the high-tension transmission lines.

There is only one power drop in the aqueduct line first to be constructed, and this is situated close beside the main highway at Moccasin Creek, 6 miles easterly from where the aqueduct line crosses the main Tuolumne River and about 141 miles distant from the city. This will be the site for Power House No. 1. The aqueduct capacity from the temporary intake down to the power house will be somewhat more than 620 second-feet, which is the equivalent of 400,000,000 gal. daily. The gross fall will be 1425 ft. Under working conditions, however, the net fall will be about 1250 ft. when 620 cu. ft. per second are flowing. It is estimated that 70,000 mechanical hp can be developed here for twenty-four hours per day under exceptional conditions for efficiency and low cost of operation.

When the 12 miles of aqueduct upstream from the temporary intake to the Hetch Hetchy dam are constructed, another power drop will become available immediately to the rear of the first intake, or about a mile upstream from Cherry Creek, with the same 620 second-feet of water previously mentioned. Power House No. 2 will be situated at this point, 160 miles distant from the city via the aqueduct route. The gross fall here will be 1425 ft., but, under working conditions and allowing for the hydraulic gradient, the net drop will be 1325 ft. The estimated development is 75,000 mechanical hp, twenty-four hours per day throughout the year.

Power House No. 3 will be situated at the Cherry-Eleanor tunnel to the Hetch Hetchy reservoir, and it is estimated that 12,500 mechanical hp can be developed here when the ultimate arrangements are completed. The total power which can be developed on these three sites, according to plans, is 157,500 mechanical hp, which will be available twenty-four hours per day and 365 days in the year. It is also estimated that 200,000 hp can be developed on peaks. At all three sites the cost of the power house and the hydroelectric equipment will be exceptionally small and the flow of water uncommonly constant and dependable. Power development, however, has been treated as subordinate to domestic water supply, and the plans have been prepared under this fundamental policy, so that hydroelectric energy is practically a by-product. The transmission line would be erected mostly along the aqueduct rights of way and would be 150 miles long to San Francisco and 135 miles to Oakland.

To-day, however, with cheap oil fuel and three large hydroelectric enterprises bringing electric energy to the city and competing actively for business under the oversight of a public service commission, there appears to be no immediate need for the municipality to engage in the business of distributing and selling electric energy. Moreover, it is said that the city charter will not permit of this. But the time will inevitably arrive when the power privilege will be one of the valuable assets in this water-supply project. There will doubtless be a limit to the era of oil at present prices, and the demands for electric energy are undoubtedly destined to grow faster than the population. Electrochemical industries which require large quantities of cheap electrical energy would also be attracted to the San Francisco district and enhance its prosperity.

This remarkable report is devoted mainly, of course, to the question of water supply for domestic and public consumption. It is copiously illustrated with examples of similar projects undertaken elsewhere. It was published by authority of the San Francisco Board of Supervisors, and copies have been on sale at $3 each.

ILLINOIS LEGISLATIVE HEARINGS ON PROPOSED PUBLIC-SERVICE COMMISSION.

During the period of the hearings of the Illinois Legislative Public Utilities Commission in Chicago in relation to the proposed state public-service commission or commissions Mayor Harrison expressed his sentiments in a formal way by sending a communication to the City Council. He asked the aldermen to pass a resolution to the effect that if public-service commissions are found necessary in Illinois, one shall be appointed having jurisdiction over Chicago only, with its members appointed by the Mayor with the consent and approval of the City Council. An accompanying resolution, which calls for local self-government in the matter of regulating Chicago utilities, was sent to the committee on judiciary. However, many of the aldermen opposed any commission, even with the appointing power vested in the Mayor. At the same meeting a resolution was introduced in the City Council providing for the creation of a bureau of the Chicago city government to regulate local utilities. This matter was sent to the finance committee.

At the hearing of the legislative commission on Nov. 26 the first witness was Mr. James F. Meagher, counsel for the People's Gas Light & Coke Company. Mr. Meagher, speaking for himself, adopted a rather pessimistic tone and said the only safety he could see for public-service corporations was by appealing to the courts. He does not think that public-service commissions are apt to be of much benefit. The courts will give a real consideration to the real facts when the occasion arises. They are not much impressed with rates for public utilities made simply to carry out a campaign pledge without any regard to what is just. The function of rate-making is perhaps the most supreme of all sovereign powers of the State, yet not one man in a thousand understands its underlying principles. If the utilities must go to the courts in any event, why interpose a commission?

There was some discussion of the local gas situation and of the political activities of Mayor Harrison and the Seventy-Cent Gas League in this matter. Mr. Meagher was rather sarcastic in telling the story, but nevertheless he agreed with Senator Edward J. Glackin, of Chicago, a member of the legislative commission, in opposing the idea of a state public-service commission. Senator Glackin's ground for opposing it was that he believed in "home rule," while Mr. Meagher was of the opinion that it is practically useless to establish such a commission, as the utility companies will have to appeal to the courts anyway.

Mr. William G. Beale, counsel for the Commonwealth Edison Company, also addressed the commission. He referred to the problem as a serious one and said that he was frank to say that if he had to decide he could not tell offhand what his decision would be; in other words, he was "on the fence." Commission regulation seems to be the present accepted way of regulating the rates of public-service companies; nevertheless, the experience of the Commonwealth Edison Company of Chicago under a contract ordinance made with the city authorities has been quite satisfactory, so that the company has no complaint up to the present time. There is a strong sentiment in Chicago in favor of "home rule" and it cannot be ignored. It would seem to be all right, perhaps, to permit a municipality to regulate its own local utilities, and yet in the case of telephone service, interurban railway service, electrical transmission and no doubt other utilities one utility may serve a number of municipalities, and if there are two or more commissions regulating its affairs there would be a possibility of embarrassment and entanglement.

At the session of Nov. 27 Mr. William J. Pringle, former alderman, and chairman of the City Council committee on gas, oil and electric light during the administration of Mayor Busse, declared himself in favor of the state regu-

lation of public utilities. He expressed himself as undecided as between one or two or more commissions, but said that if there were only one commission it should arrange to spend much of its time in Chicago and to be accessible to complaints at all times.

At the hearing of Nov. 29 all of the ten members of the legislative commission were present for the first time during the hearings in Chicago. Mr. W. H. Sexton, corporation counsel for the city of Chicago, told of the work done by the city on the proposed passenger subway system and also discussed the gas situation in Chicago. In relation to the latter he admitted that it was a political question during the last mayoralty campaign and said that he thought the adjustment of such questions must always be treated politically when arising during campaigns for the election of municipal officers.

Mr. Leonard A. Busby, president of the Chicago City Railway Company, described the dealings of his company with the local transportation committee of the City Council, through which complaints of service are handled and where the relations of the city and the company are discussed, and also with the Board of Supervising Engineers, which acts as the disinterested expert in carrying out the provisions of the 1907 traction settlement ordinances. Mr. Busby explained the street-railway "through routes" from one part of the city to another and told about the city's effort to bring about the merger of the surface street-railway systems. In answer to a question he made some interesting references to the purchase of electrical energy from the Commonwealth Edison Company. The railway company finds it cheaper to buy electricity than to make it. The rate consists of a primary charge of $15 a kilowatt per year and a secondary charge of 0.4 cent per kw-hr. This is a very low rate, but the company is using slightly in excess of 45,000 kw.

Mayor Harrison of Chicago was the "star witness" at the morning session of Nov. 30. The Mayor had been subpœnaed, but his first statement was to the effect that a writ was not necessary to secure his presence. The Mayor does not favor state regulation of public utilities, at least in Chicago. The entire question, he thinks, is in the formative period. The present method of regulation in Chicago, by committees of the City Council, aided by expert advice, is satisfactory. The personnel of the various committees changes but slowly, and the members come to be almost experts themselves. Chicago has, in fact, led the way in the municipal regulation of utilities. The Mayor would be loth to see any step taken to cause the city to lose the advantage it has gained by years of fighting. Of course, this advantage depends on the honesty and ability of the aldermen, but that would also be true in the case of a state commission. The present tendency in Chicago is toward the permanent employment of experts as heads of departments. As an instance of this the speaker cited the case of the city electrician, a well-qualified man, who is now engaged in making an investigation of the rates of the Commonwealth Edison Company. Mr. Harrison also mentioned in an appreciative manner the fact that the electric-service company has made a number of voluntary reductions in rates. He hopes that Chicago will be left to handle these questions itself. The heads of city departments should be experts and left in office during successive administrations as has been the practice for many years in the case of the chief of the Fire Department.

In answer to questions the Mayor explained his views on the transportation situation. Referring to the congestion of downtown streets he made the interesting announcement that the city is considering the project of securing a site on the Lake Front (Grant Park) for the parking of automobiles, so that no automobile shall be allowed to stand anywhere else in the downtown district for more than, say, ten minutes at a time. The Mayor also declared, in answer to another question, that he was still a believer in the ultimate municipal ownership of local utilities. In dealings with utility companies service should be the first consideration rather than monetary compensation to be paid into the city treasury.

Commissions appointed by the Governor of the State have not always given good service in Chicago, according to the Mayor, who cited the records of some of the park boards to prove this. In any appointive commission there is the possibility that a mistake may be made in selection owing to an error of judgment or political "pull." The City Council, on the other hand, is elected directly by the people. However, if the Legislature should create a public-utility commission for Chicago and vest the power of appointment in him, Mayor Harrison promised to do his level best to make good appointments. As an individual the Mayor would not say that he would oppose the creation of a district commission for Chicago. He declared, however, that the views of the City Council must be taken into account.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

Reports of accidents on the railroads and street railroads in Greater New York during the month of October were summarized and a report given out by the Public Service Commission for the First District a few days ago. The total number of persons killed was 29, the total number of serious injuries 208, and the total number of personal injuries 3771. All accidents, including the personal injuries, totaled 6263.

NEW YORK COMMISSION, SECOND DISTRICT.

The Public Service Commission, Second District, has directed its counsel to commence an action against the New York Telephone Company for failure to comply with the commission's order made on Oct. 15, 1912, directing it to furnish telephone service to the Metropolitan Telegraph & Telephone Company in accordance with the demand of the Metropolitan company and upon the payment for such service one month in advance, and to place the name of the complainant among the subscribers in the usual manner in which subscribers' names are placed in the directory. On Nov. 11 the commission denied the petition of the New York Telephone Company for a rehearing and the Metropolitan company now advises the commission that it has not been furnished with service nor listed in the directory.

The commission has given its approval to the sale of the power plant of the Rochester, Syracuse & Eastern Railroad Company at Lyons and the power plant of the Auburn & Syracuse Electric Railroad Company at Auburn to the Niagara, Lockport & Ontario Power Company. The approvals are given upon the express condition that they are not in any event to be construed as an authorization for the Niagara company to distribute power or electrical energy or to operate in any territory whatsoever as an electrical corporation by reason of any agreement which would otherwise require the authorization or consent of the commission. The approval is also not to be construed as an approval of any construction of transmission lines by the Niagara company, and any further construction requiring the consent of the commission must be taken up in a separate proceeding.

Under the terms of a contract approved by the commission the power company is to sell electric power to the so-called Beebe roads for a term of twenty years from Dec. 1, 1912. A provision is made for the furnishing of all power needed for the operation of the road or any extensions, additions and improvements, connecting roads, etc. The railroads agree to purchase exclusively from the power company during this term energy delivered to the transmission lines of the railroad at the Lyons power house or at

one of the substations of the Rochester road located near Lyons, and also at a point near Halcomb, Onondaga County.

Under the new arrangement the electric railroads will have not only the service of the Niagara, Lockport & Ontario Power Company, but the benefit of the steam reserve plant located near the eastern end of its transmission lines, which will give to the railroad company's supply of power east of Rochester better regulation and greater safeguards against interruptions of service. The commission has also authorized the Niagara, Lockport & Ontario Power Company to incur an indebtedness of $600,000 for the purchase of the Lyons plant and a further indebtedness of $226,000 for the purchase of the Auburn plant.

MASSACHUSETTS COMMISSION.

The Mayor of Newburyport has petitioned the Gas and Electric Light Commission for a reduction in the rates now in force for gas and electricity on the system of the Newburyport Gas & Electric Company. A complaint has also been filed with the board by the selectmen of Rockland against the prices for street lighting maintained by the Electric Light & Power Company, of Abington and Rockland.

Hearings have been concluded by the joint commission designated by the last Legislature to investigate the status of holding companies in Massachusetts, and a report on the subject will be made to the next General Court soon after it convenes in January. The Gas and Electric Light Commission and the Railroad Commission sat as a part of the joint board in the hearings, and a large amount of testimony was advanced on behalf of and in criticism of the holding company idea. Representatives of central station organizations defended the voluntary association as a necessary device for financing groups of public utilities physically or legally unrelated.

NEW JERSEY COMMISSION.

The Board of Public Utility Commissioners has denied an application of the Trenton Chamber of Commerce for suspension of a proposed increase of 50 cents per month in the charge for residence telephone service by the Delaware & Atlantic Telegraph & Telephone Company. In ruling on this matter the board stated that the ordinary application for the suspension of increased rates comes to the board without any specific knowledge on its part of the particular circumstances under which the increase is made. The board has been for some time investigating the rates charged by the Delaware & Atlantic Telegraph & Telephone Company in the city of Camden. The proposed increase in Trenton will have the effect of aligning Trenton rates with those of Atlantic City and Camden. The board states that the evidence in the Camden case is sufficient to rebut the presumption which ordinarily would exist in favor of the established rate in Trenton. The increase is declared to be prima facie in the nature of eliminating discriminatory and preferential rates for the Trenton area. At a recent hearing before the board it was agreed by the Trenton Chamber of Commerce that it would not push its complaint as to the reasonableness of the Trenton rates until after the decision of the board on the reasonableness of the rate charged in Camden.

MARYLAND COMMISSION.

The Frederick Board of Trade will carry to the Public Service Commission the question of telephone rates in Frederick County. It is contended that the rates charged by the Chesapeake & Potomac Telephone Company in Frederick County are not uniform for the class of service given, according to some complaints made to the members of the Board of Trade. Chairman Laird of the commission has informed the Frederick Board of Trade that it may bring its charges before the commission and that an early hearing will be given the case as the Cambridge Board of Trade has a similar case pending.

OHIO COMMISSION.

The Washington Gas & Electric Company, of Washington C. H., has been authorized to issue $100,000 new bonds with which to retire those outstanding and make extensions. For the purpose of making other improvements the company was also authorized to issue $50,000 new stock.

On a second application the Ohio Traction Company was given permission to issue $750,000 additional stock with which to reimburse the income account for money spent in making improvements during the past five years. The second application was filed by President W. Kelsey Schoepf and was accompanied by an exhaustive brief as to why this step should be taken.

The application of the Dayton Power & Light Company for permission to issue $150,000 stock to exchange for the stock of the Miami Light, Heat & Power Company, which had been purchased some time ago, was approved by the commission recently.

WISCONSIN COMMISSION.

In the case of the Milwaukee Electric Railway & Light Company against the Wisconsin Railroad Commission, Judge Stevens in the Circuit Court has issued an order granting the request of the plaintiff for a stay of execution of the judgment rendered against it during the pendency of its appeal to the Supreme Court. The stay of execution also includes the order of the commission which called for the sale of thirteen street-car fare tickets for 50 cents. Judge Stevens ordered the plaintiff, however, to continue to issue a coupon with every sale of twelve tickets which will be good for one fare in case the company loses its case.

Current News and Notes

TELEPHONE PIONEERS OF AMERICA.—The office of the secretary of the Telephone Pioneers of America has been removed to larger quarters at 30 Church Street, New York, Room 730. Pioneers visiting the city will be welcomed.

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WIRELESS TOWER 917 FT. HIGH.—The new tower of the German Wireless Company's station at Nauen which is now in course of erection will reach a height of 917 ft., making it the highest wireless tower in the world. It is expected that the company will be able to send messages nearly 6000 miles, or practically the distance from Berlin to Chicago.

* * *

OFFICERS OF THE ELECTRIC CLUB OF PORTLAND.—The Electric Club of the Portland (Ore.) Railway, Light & Power Company at a recent meeting elected these officers for the ensuing year: President, Mr. F. W. Hild, general manager of the Portland Company; vice-president, Mr. A. C. McMicken, and secretary, Mr. M. B. Grenfell. A number of the club members are planning to take up university extension work under the auspices of professors from the University of Oregon.

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COURT DENIES EDISON'S INVENTION OF MOVING-PICTURE FILM.—The Court of Appeals of the District of Columbia on Dec. 2 delivered an opinion denying that Edison was the inventor of the moving-picture film and reversing the decision of a lower court granting an injunction and damages to Mr. Edison's assignees against a film company in Chicago. The court declared that the moving-picture film was neither invented nor discovered by Mr. Edison, but was the production of a maker of photographic supplies. In its written opinion the court does not "dissent from the proposition that Mr. Edison solved the problem of the moving-picture art with great ingenuity and skill," but points out that "the problems he solved were in the camera apparatus wherein his true claim to invention lies."

GAZETTEER OF THE SURFACE WATERS OF CALIFORNIA.—The October issue of the *Monthly Catalogue*, United States Public Documents, announces that Part II of Water Supply Paper No. 295, entitled "Gazetteer of the Surface Waters of California," is now ready for distribution. This portion covers the San Joaquin River basin. Part I, previously issued, covered the Sacramento River basin.

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JOHNS HOPKINS ENGINEERING SOCIETY.—The first meeting of the Johns Hopkins Engineering Society, which was recently formed by the students in the technical school, was held during the past week in the physical laboratory of the university. The meeting was addressed by Mr. B. Howell Griswold, Jr., one of the trustees of the university, who has been largely instrumental in persuading the last Legislature to appropriate $600,000 for the erection of buildings for the technical school and to promise a yearly gift of $50,000 to that school.

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INTERNATIONAL WATERWAYS COMMISSION.—President Taft in a special message to Congress on Dec. 3 asked that appropriations for the American section of the International Waterways Commission be continued until it could make final recommendations as to a dam at the outlet of Lake Erie at Buffalo and conclude the work of marking the boundary between the United States and Canada, which will take about fifteen months. The last appropriation for the American section expired with the opening of the present session of Congress.

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PROPOSED PATENT REFORM, BY TEXAS ATTORNEY-GENERAL.—At the recent gathering of the National Association of Attorney-Generals, held in St. Louis, Attorney-General Walthall of Texas advocated repealing and completely revising the present patent laws. Mr. Walthall suggested that a patent commission be named to fix the price of inventions and to remunerate inventors from the United States Treasury. The government could then collect a royalty upon the use or sale of the patented article and thereafter release the invention to the public.

* * *

VOLUME IX OF PUBLIC DOCUMENT CATALOGUE.—It is announced in the October *Monthly Catalogue*, United States Public Documents, that Vol. IX of the series of catalogs of public documents of the United States, issued from the office of the superintendent of documents, is now ready. It records the publications of the legislative branch of the government which were ordered printed during the life of the Sixtieth Congress, March 4, 1907, to March 4, 1909, and the publications of the executive and judicial branches issued during the two fiscal years July 1, 1907, to June 30, 1909. The catalog fills 1830 large, double-column, closely printed pages.

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REDUCTION OF OHIO LIABILITY INSURANCE RATES.—Announcement has been made public by the Ohio State Liability Board of Awards of a further reduction of the insurance rates for employers' liability under the State insurance plan, effected through a revision of its rule in reference to ratings. This adds still more to the reductions, ranging from 15 per cent to 65 per cent, announced recently. Industries of a certain class showing a small number of accidents per $100,000 of payroll will benefit from the added reduction. In order to equalize this, the rates will be increased where accidents prove more numerous; 3 per cent will be added to the rate for every accident above ten for each $100,000 of payroll.

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EAST BOSTON TUNNEL TO BE EXTENDED.—The Boston Transit Commission has begun work upon an extension of the East Boston tunnel westward from Scollay Square under Bowdoin Square and Cambridge Streets to the vicinity of the Charles River Basin. The tunnel is now operated by the Boston Elevated Railway Company and since its completion several years ago has provided a short route between the heart of the city and its island suburb at the east. Upon the completion of the extension facilities will be available for continuous transportation between East Boston and Cambridge at greatly decreased running times. Two new subway stations will be built in connection with the work, one under Scollay Square and the other under Bowdoin Square. At present the tunnel is operated with a stub-end terminal in Boston which seriously limits its traffic capacity.

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SASKATCHEWAN COAL FIELDS.—According to latest reports, there are 2,000,000,000 tons of lignite coal in the fields south of Regina and Moose Jaw, in the Province of Saskatchewan, Canada, in addition to large quantities of such fuel extending at intervals all the way from Estevan to North Battleford. It is said that this interesting information is divulged in a report to the provincial government by Mr. R. O. Wynn-Roberts on the feasibility of developing gas and power from the lignite deposits throughout the Province. The cost of producing mechanical power in Regina at the present time is reported to be about $60 per hp-year. It is therefore expected that the making of briquettes from lignite coal and the development of both power and gas from the same source will be practicable and economical and will prove to be an important factor in the development of the cities throughout the Province.

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PRIZE CONTEST, NEW YORK COMPANIES' SECTION, N. E. L. A.—The contest committee of the New York Companies' Section of the National Electric Light Association has formulated a plan for determining the selection of delegates to attend the Chicago convention next year. Prizes of $125 each will be allotted to the four leaders in the contest. The plan proposed in awarding points is as follows: Attendance at meeting, maximum of five points each month; subject matter for the bulletin, maximum of five points each month; securing new members for the section, maximum of five points each month; suggestions submitted monthly for the benefit of the lighting industry, maximum of fifteen points each month; discussion at monthly meetings, maximum of thirty points each month; presentations of monthly papers to the contest committee, maximum of forty points each month. It is stipulated that the papers submitted shall contain not fewer than 1000 nor more than 2500 words.

* * *

BOSTON & PROVIDENCE INTERURBAN LINE TO BE BUILT.—It was announced at Boston last week that the proposed electric high-speed interurban line planned by the Stone & Webster interests, to be built between Boston and Providence, R. I., will be carried through without regard to the loss in right-of-way which the company had expected to secure from the Southern New England Railway prior to the withdrawal of the latter from New England at the behest of the Grand Trunk Railway. Mr. A. Stuart Pratt, of Stone & Webster, stated in this connection that the company would in all probability endeavor to obtain its own right-of-way into Providence. Mr. E. S. Webster, of the firm, stated that no negotiations have been held between the promoters of the new company and the New Haven system. Branch lines have been surveyed to New Bedford, Fall River and Taunton, Mass. The new line is expected to compete with the New Haven lines in all branches of service.

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DEWEY DECIMAL SYSTEM APPLIED TO CLASSIFICATION OF ENGINEERING DATA.—In 1906 the Engineering Experiment Station, University of Illinois, Urbana, Ill., issued a publication entitled "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," prepared by Prof. L. P. Breckenridge and Mr.

G. A. Goodenough. This publication was issued as Bulletin No. 9. The original publication was distributed gratuitously, according to custom, and the subsequent demands for it were such that a second edition was printed and ultimately distributed. Altogether 20,000 copies were sent out. The demand having continued, it was finally decided to revise and print a new edition, which is limited. A revision has been made in accordance with the 1911 edition of "Decimal Classification" by Mr. Melvil Dewey. Copies are for sale at 50 cents each and may be obtained by addressing Prof. W. F. M. Goss, director of the Engineering Experiment Station.

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SOCIETY MEETINGS.

Southwestern Gas & Electric Association.—The next annual convention of the Southwestern Electrical and Gas Association will be held at Galveston, Tex., May 21-24, 1913, with headquarters at the new Galvez Hotel. Mr. H. S. Cooper, 405 Slaughter Building, Dallas, Tex., is secretary of the organization.

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Electrical Association of the Province of Quebec.—At the last monthly meeting of the Electrical Association of the Province of Quebec it was decided to abolish the monthly meetings and in their stead to hold weekly luncheons. Professor L. A. Herdt, of McGill University, addressed the association at its last luncheon in Montreal, his topic being "Recent Developments in Electricity."

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Electrical Society of Columbia University.—The next meeting of the Electrical Engineering Society of Columbia University will be held on Dec. 12 at 8:15 p. m., in Room 301 of the Engineering Building, Columbia University, 116th Street and Broadway, New York. Mr. R. B. Treat, of the Crocker-Wheeler Company, will lecture on "The Application of Electric Motors to Steel Mills" at this meeting. Mr. Cornelius Kroll is secretary of the association.

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Detroit-Ann Arbor Section of the A. I. E. E.—At the meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers held Nov. 23 the following officers were elected: Chairman, Mr. J. J. Woolfender, Detroit; vice-chairman, Mr. S. G. Dinsmore, Detroit; secretary, Mr. R. K. Holland, Ann Arbor; vice-secretary, Mr. G. W. Krause, Detroit. During the evening Mr. Holland gave a talk on the new Barton dam of the Eastern Michigan Edison Company which is now being erected at Ann Arbor, Mich.

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December Meeting of New York Companies' Section, N. E. L. A.—A meeting of the New York Companies' Section of the National Electric Light Association will be held on Dec. 16 at the Edison Auditorium. The topic to be discussed is watt-hour meters. Mr. Samuel G. Rhodes, head of the meter department of the New York Edison Company, will preside, and it is expected that representatives of the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Sangamo Electric Company and also representatives of various central stations will take part in the discussion.

* * *

San Francisco Electrical Development League.—At the last regular monthly meeting of the Electrical Development League of San Francisco the guest of honor was Mr. Walter A. Chowen, vice-president of the Pacific Surety Company. Mr. Chowen read a paper on the subject of the new employers' liability law enacted by the Legislature at its last session. The heavy indemnities for which employers are liable in case of the accidental deaths of employees, payable to their heirs, have discouraged employers, Mr. Chowen said, from engaging married men. In his opinion, the adoption of a strict safety appliance law would tend to lower the rates of liability insurance. Mr. H. V. Carter is president of the league and Mr. E. B. Strong is secretary-treasurer.

* * *

Minnesota Section, A. I. E. E.—At a meeting of the Minnesota Section, American Institute of Electrical Engineers, held at McCormick's café, Minneapolis, Nov. 11, Mr. Lincoln Nissley, construction engineer for H. M. Byllesby & Company, presented a paper on transmission-line construction. The subject was discussed by Prof. George P. Shepardson and Messrs. R. A. Lundquist and A. Aspnes. Mr. W. C. Beckjord, construction engineer for the St. Paul Gas Light Company, followed with an illustrated talk on the erection of a 1700-ft. span over the St. Croix River, and Prof. W. T. Ryan discussed results of tests made on an experimental span.

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Boston Branch, A. I. E. E.—At a regular monthly meeting of the Boston branch of the American Institute of Electrical Engineers on Nov. 21 Mr. H. J. W. Fay, assistant general manager of the Submarine Signal Company, Boston, Mass., read a paper on the application of electricity to submarine signaling. The author described the development of marine signaling from the earliest days of beacon fires on dangerous headlands to the present time, and outlined the progress made in the design of apparatus for the transmission and reception of under-water signals to secure clear and accurate indications without interference by outside noises. Mr. Fay's discussion of the subject followed the lines of his paper read at the Boston convention of the Institute on June 27.

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Philadelphia Electric Company Section of N. E. L. A.—The second regular meeting of the Philadelphia Electric Company Section of the N. E. L. A. for the season 1912-13 was held in the Franklin Institute on Nov. 18, 1912. Preceding the meeting a dinner was held at the Continental Hotel. The paper of the evening was on "Resuscitation from Electric Shock" by Dr. Charles A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company. After Dr. Lauffer's paper was read Mr. B. Frank Day, chairman, who presided, introduced Mr. W. C. L. Eglin, a member of the N. E. L. A. Commission on "Resuscitation from Electric Shock," who called attention to the advantages of the Schaefer prone-pressure method over the Sylvester method so long in vogue. Mr. Maddox, of Chester, discussed the paper of the evening and felt that more emphasis should be placed upon this important method by medical schools. The discussion was followed by a demonstration of the Schaefer method directed by Dr. Lauffer and Mr. Eglin. The second meeting of the Meter Department Branch of the Philadelphia Electric Company Section was held on Nov. 1. The meeting was addressed by Mr. William Bradshaw, of the Westinghouse Electric & Manufacturing Company, who discussed many problems incident to the design and manufacture of the electric meter. A very animated discussion followed the address. The second meeting of the accounting department branch of the Philadelphia Electric Company was held Nov. 12. In the absence of the chairman, the vice-chairman, Mr. G. P. Landwehr, presided. The first paper of the evening was "Filing and Indexing and Its Aid to Modern Business," by Mr. W. L. Cowperthwait, of the consumers' division. A general discussion followed the reading of the paper. The guest of the evening was Mr. George A. Henrich, district manager of the Burroughs Adding Machine Company, who spoke upon the theme "The Advance of Clerks in the Accounting Department." The second regular meeting of the commercial department branch was held Nov. 25, Mr. Walter T. Dyre presiding. The subject of the evening was "Heating Appliances," and Mr. F. W. Smith's paper, as originally presented at Association Island, was read.

A UNIQUE UTAH WATER-POWER.

New Riverdale Plant of the Weber & Davis Counties Company, Utilizing Irrigation Canal.

1400 Ft. of 8-Ft. Penstocks Carrying Full Pressure of 200-Ft. Head—Design Adopted to Resist Impact Heads—Synchronous Relief Valves and Water-Saving Devices.

IT was through the Weber Canyon, a fortunate rocky pass in the Wasatch Mountains of Northern Utah, that the intrepid builders of the Union Pacific Railroad, having surmounted the crest of the continent, finally descended into the broad, fertile valley of the Great Salt Lake, already a thriving region of Mormon industry and culture. Ogden, then the chief city of the poplar-studded plain, in turn underwent a distinct movement south to meet the railroad, leaving the old civic center to become an outlying residence suburb of the city of to-day. But, besides bringing Ogden its intercourse with the world outside and moving the city almost bodily a couple of miles, the Weber River and the Weber Canyon had other good things in store for this community of Latter Day Saints, including irrigation of the countryside for miles around and, more recently, even hydroelectric energy for lighting the city and operating interuban railways connecting it with other cities in the valley of Zion.

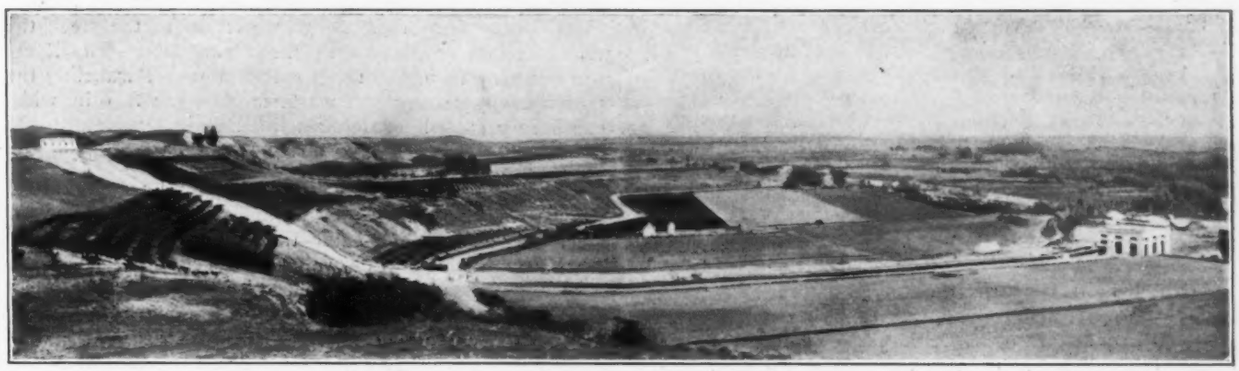


Fig. 1—Panoramic View of Riverdale Development, Near Ogden, Utah.

IRRIGATION CANAL AND SITE.

For a number of years the Davis & Weber Counties Canal Company has operated an extensive irrigation system supplying a large district near Ogden. By means of a canal extending far up the Weber Canyon and paralleling the railroad's right-of-way, water is diverted from the Weber River and led out through a concreted channel which for miles skirts the foothills and marginal slopes of the lower river, supplying water to the farms below and beyond. Realizing the water-power possibilities of the project originally installed for irrigation purposes, it was found possible to develop over 13,000 hp with the 200-ft. head available between the canal and the river. Of this total capacity, an initial installation of 3750 hp has now been completed.

At the point selected as the most advantageous for this development the river flows on the far side of an old, broad flood-plain (now rich farmland), bringing the natural discharge channel more than half a mile from the hillside canal. The water-power plant was accordingly located at about the midpoint of this 2800-ft. distance, being supplied through steel penstocks 1400 ft. in length, while a tailpiece of about the same length had to be excavated to connect the turbine draft tubes with the river.

In many respects the new Riverdale plant is therefore unique, having huge steel penstocks of extraordinary length under full hydraulic head and special features of design to control and withstand the unusual normal and impact forces involved in these great moving masses of water. Utilizing its own available resources to the limit, the plant also "borrows" the flow of an independent irrigation ditch, later returning it to the lower channel by means of a centrifugal pump after extracting the net energy of nearly 200 ft. of fall, which would otherwise be wasted. In spite of the difficult natural conditions to be overcome and the completeness and excellence of its equipment, the present plant has been erected at a very low cost, declared to have been less than $45 per kw.

The point of diversion of the main irrigation-ditch supply is in the Weber Canyon, 8 miles from the power house. The 30-ft. channel has been concreted, rendering it waterproof and permitting higher velocities of stream flow without danger of "washing" the sides. Originally 325 cu. ft. per second was the water allowance granted the irrigation company, but this quantity has since been augmented by additional filings of 300 cu. ft. per second. These amounts do not include, however, the 18 cu. ft. per second obtained from the Riverdale ditch which passes the plant. From Sept. 15 to April 15, 643 cu. ft. per second is thus available for water-power use. During the remaining months of the year which comprise the irrigation season only 318 cu. ft. can be taken.

GATEHOUSE AND PENSTOCKS.

As initially installed, there are at present two principal waterwheel units, one of 2500-kw and the other of 1250-kw rating. Each is separately supplied from the gatehouse through its own steel tube, about 1400 ft. in length. To form the forebay, the 30-ft. concrete-lined canal on the side of the hill has been widened to 60 ft. for a distance of 250 ft., providing a basin which is in part closed on the plant side by the gatehouse. This concrete and brick structure provides four penstock openings, including two future outlets for additional 2500-kw units. Trash racks protect the intakes of the present penstocks, which can be closed respectively by 96-in. and 72-in. sluicegates, operated by 3-hp induction motors. These gates work under 19-ft. head and can be manipulated from the power house or from the gatehouse itself, as desired.

In the first 400 ft., as made clear by the accompanying illustrations, the penstock tubes drop 173 ft., reaching the flood-plain surface, on which they are carried, practically level, for a distance of nearly 1000 ft. to the power house. Both hillside and level are made up of sand and gravel, and on this the steel tubes are carried by about twenty concrete saddle piers, resting directly on the gravel-bed footings.

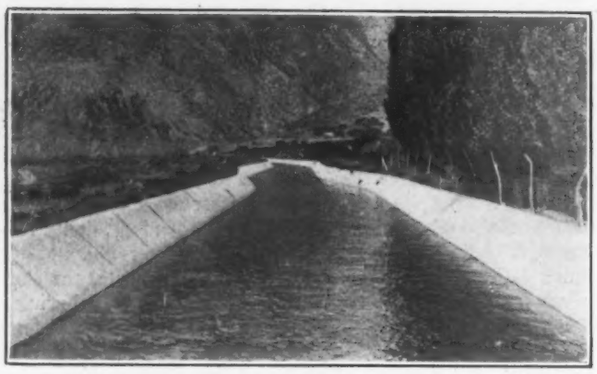


Fig. 2—Irrigation and Power Canal Leaving Weber Canyon.

The steel penstocks vary in diameter and thickness with the normal hydrostatic head and hydraulic impact possible for the three sections, as shown in the accompanying table.

DIMENSIONS OF STEEL PENSTOCKS.

	2500 Kw.		1250 Kw.	
	Diameter.	Thickness.	Diameter.	Thickness.
First 520 ft	87 in.	0.25 in.	65 in.	0.25 in.
Next 437 ft	76 in.	0.38 in.	56 in.	0.38 in.
Last 432 ft	65 in.	0.57 in.	46 in.	0.44 in.

The velocity of the water through the penstocks at normal turbine rating is about 6.6 ft. per second, and the friction loss a little over 4 ft. of hydraulic head, making a net head of 200 ft. available at the machines under full-load conditions. The strength of the lower sections of the penstock and the anchoring of the tubes has been designed to give a factor of safety of three when withstanding the full inertia impact of 80 per cent rise in pressure due to closing the lower valves in three seconds. This feature, coupled with the extra precautions taken to secure close regulation of turbine speed and generator voltage, has made the use of a surge tank unnecessary, despite the long pipe lines. The upper lengths of the pipes are protected against inward collapse due to emptying of the tubes by suitable vents. As the altitude of the station is 4800 ft., the barometer level stands much below the normal readings of places nearer sea level, and this reduced atmospheric pressure must be taken into consideration in designing draft tubes, relief valves, etc.

Variations in length of the penstock tubes with temperature changes are provided for by expansion joints with sliding sleeves and fiber packings. There are four of these joints in each pipe, and each joint permits several inches movement. The joints are mounted on concrete foundations, firmly anchored. As a protection to the steel, the tube interiors are lined with Sarco compound. The Ryerson company furnished the penstock pipes. Paralleling the power-supply penstocks, a wasteway flume, 4 ft. 6 in. wide, has been provided for, but remains unbuilt.

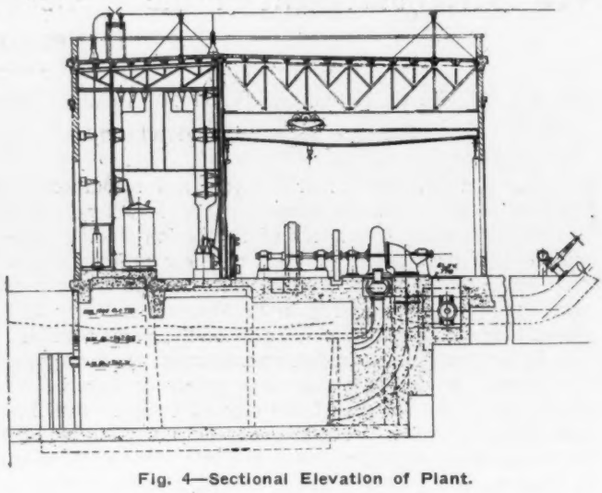


Fig. 4—Sectional Elevation of Plant.

POWER HOUSE AND TURBINE UNITS.

Entering the power house, the supply lines are taken through hydraulic valves, 60 in. and 42 in. in diameter respectively, and thence enter the horizontal, inward-flow, reaction-type, single-discharge waterwheel units. These are Allis-Chalmers machines equipped with special Allis-Chalmers oil-pressure governors which regulate within 1.5 per cent for load changes from full load to no load. Linked to the governors are synchronous relief valves which, with the closing of the turbine wickets, automatically open a by-pass discharge having a capacity 15 per cent greater than that of the turbine itself at full load. In this way, despite sudden changes in the turbine-gate openings, the amount of water flowing in the penstock pipes is not immediately arrested but is diverted to the by-pass channel, thus avoiding impact heads due to suddenly stopping the long moving columns. These synchronous relief valves are also equipped with water-saving devices which next slowly close the by-pass openings, reducing the penstock flow gradually, without rise in pressure. The relief-valve and water-saving mechanisms are operated positively by the governors and

Fig. 3—Head House with Remote-Controlled Headgates.

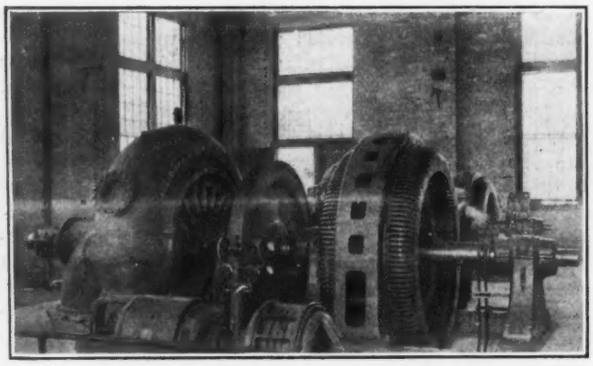


Fig. 5—Waterwheel Sets in Power House.

can be adjusted to work at any desirable time interval for opening and reclosing the by-pass. The governors use oil at 200 lb. pressure and exert a controlling force of 18,000 ft.-lb.

The 3750-hp waterwheel unit is direct-connected to a 2500-kw alternator, and the 2000-hp unit to a 1250-kw alternator, both General Electric 2300-volt, 60-cycle, three-phase machines. To assist in speed regulation, both sets carry large flywheels. The 16,500-lb. wheel on the 2500-kw set has a moment of inertia of 100,000 ft.-sq.-lb., while the 9000-lb. wheel on the smaller unit adds 58,000 ft.-sq.-lb. of flywheel effect.

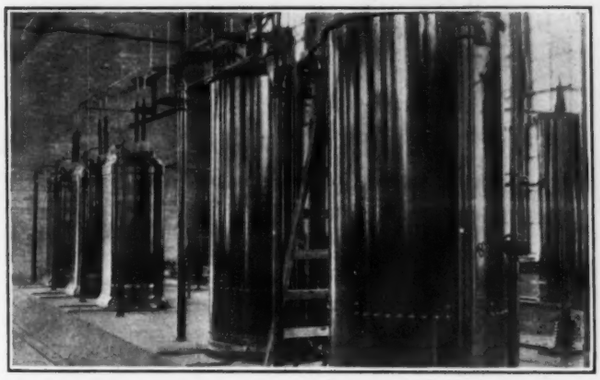


Fig. 6—Step-Up Transformers, Riverdale Power House.

EXCITERS AND AUXILIARIES.

Excitation for the main alternators is provided by two 50-kw, 125-volt direct-current generators, one driven by a 2300-volt induction motor and the other by a small waterwheel. The supply for this exciter turbine is taken from a cross header outside the power house having valve connections to both penstock pipes so that either line can be used. A Woodward mechanical governor controls the speed of the exciter turbine.

As has been mentioned, the Riverdale Bench Canal is a small artificial watercourse which supplies about 18 cu. ft. per second to farms in the flood plain of the lower Weber River. This water, used for irrigation purposes, was formerly taken from the river at a point above, such that only enough head was developed to distribute the supply to the ditches. By arrangement with the farmers owning this independent canal, at times of low water in the power-plant supply the separate intake is closed and the Riverdale Bench supply is taken far above through the Weber Canyon canal. Here its entire 200-ft. head is utilized by the plant turbines, and from the plant tailrace an equivalent quantity of water is returned to the Riverdale ditch (which is siphoned under the plant foundations) by a 100-hp, 2300-volt induction motor driving a centrifugal pump. This pump operates with a suction lift of 10 ft. and lifts its output 20 ft. above its center line. As the result of this arrangement for "borrowing" the Riverdale Bench Canal's supply, 325 hp is developed by the main turbines, of which 100 hp is required to operate the pump, making a net gain of 225 hp in case of limited water supply during the dry season, which is two months in duration.

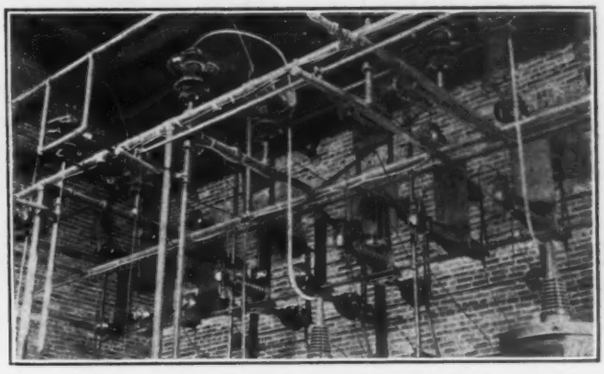


Fig. 8—High-Tension Structure and Line Entries.

ELECTRICAL EQUIPMENT.

The 2300-volt output of the generators is stepped up to the transmission pressure, 45,000 volts, by two banks of General Electric single-phase transformers, whose oil content is cooled by water circulated from the penstock supply. Both 2300-volt and 45,000-volt buses are equipped with remote-control oil switches, and the outgoing high-tension lines are provided with instrument transformers for operating ammeters, voltmeters, etc. The high-tension line switches have overload protection supplied by series relays inserted directly in the switch leads. Tubular copper buses have been used for all 45,000-volt construction, employing 0.75-in. tubing with 1/32-in. walls. The line exits are made through roof-type insulators and are protected by General Electric aluminum-cell arresters with horn-gaps on the roof.

The Davis & Weber Counties Canal Company, for which the plant was built, is a co-operative organization of local farm owners. The company disposes of its entire output at its switchboard, selling to wholesale customers who operate and maintain their own transmission lines. The Merchants' Light & Power Company, which furnishes street lighting and commercial service in Ogden, and the Salt Lake & Ogden Electric Railway, operating interurban service between these two cities, are the principal users of the energy generated in the Riverdale plant.

The H. A. Strauss Company, Chicago, designed and superintended the erection of the new Riverdale plant for the Davis & Weber Counties Canal Company, Mr. P. D. Kline being resident engineer on the work.

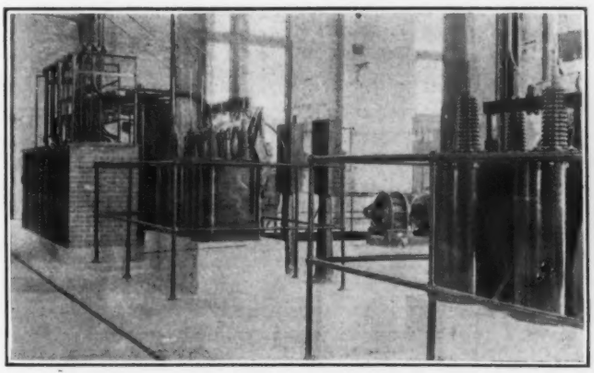


Fig. 7—Oil Switches for 2300-Volt and 45,000-Volt Circuits.

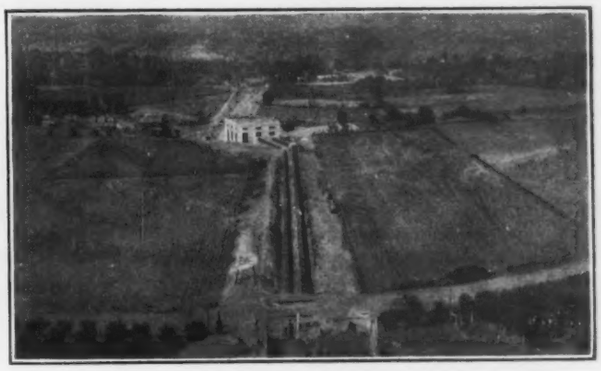


Fig. 9—Valley of Weber River from Gate House.

ELECTRICITY IN METAL MINING IN COLORADO

Wide Application Due to Adaptability and Low Cost as Compared with Other Forms of Power.

Its Use for Driving Hoists, Pumps, Drills, Fans, Railways and in Various Processes Directly Connected with the Recovery of Precious Metal from Ore.

By W. J. Canada.

METAL mining in Colorado has experienced rapid change from the placer mining of pioneer days to mining of low-grade ores from definite veins at great depths. Variation in mining methods and the treatment of ores near mines, in order to avoid shipping charges, naturally followed. Formerly $20 ore was thrown on the dump heap, and ores yielding from $100 to $300 a ton were not uncommon; to-day the average return in the Cripple Creek district is $15 a ton, but one-third of the ore mined does not yield more than $3.50 a ton.

Where available, electrical energy is usually employed by mine and mill owners, because of its ready adaptability to variations in operation to which such plants are still subject owing to difference in the amount and nature of the ore. Changed speed, changing load, increasing number of miners and drills, taxing one portion of the treatment process beyond the first design, all indicate advantages in electric drive; and when efficient power production is considered in the face of expensive coal, and frequently bad water, the reason for the popularity of the electric drive is apparent. Besides its use for general mine illumination, electricity is also employed in hoisting, in compressing air for drills, in pumping water, in driving fans for ventilating shafts and tunnels and in locomotives for hauling ore to the dumps and mills. The general character of these loads is treated separately in what follows. Alternating-current distribution is necessary, owing to the distances covered, and a tension of 440 volts is standard in all districts, making the ready interchange of motors practicable.

Fig. 1—Typical Metal Reduction Mill, Portland Gold Mining Company, Victor, Col.

HOISTS.

For the operation of mine hoists, occasionally from 2000-ft. levels and over, accurate control is necessary, in order to safeguard the lives of miners and to facilitate loading and unloading. Variations in the amount of ore produced oftentimes subject the hoist to overloads, and in order to provide for the rapid fluctuations encountered, considerable reserve in supply is necessary. For hoist service alternating-current motors, with external resistance in the rotor circuits, are generally used, with drum controller.

Most mines operate an eight-hour shift from 7 a. m. to 4 p. m. The mains supplying the hoists are generally overfused 100 per cent beyond normal motor rating, and the rating of the motors is usually considered to be 25 per cent less than the maximum demand. With induction motors and maximum speeds of 500 ft. a minute, about 15 hp per bucket ton is ordinarily installed. The demand generally approximates 1.5 kw-hr. per 1000 ft. per ton in vertical shafts.

In the past it has been the practice of service companies to discourage hoist installations, because of the comparatively low income derived from them and the bad effect of the load on the line. Except in the case of very large hoists, such loads are now considered desirable, as they usually lead to other business. In small or new plants the motor may be rented, but even if purchased outright, the total installation costs are much less than for a steam plant, and, with reasonable rates for service, the operating costs, including labor and service, are also less. For "sinking" operations, however, the possibility of failure to pull men out of the hole before "shots," because of failure of supply, has discouraged electrical-hoist applications for all but finished shafts. The initial steam plants usually installed for sinking shafts have persisted in the face of high fuel and labor costs. Where shafts are operated in conjunction with tunnels, and the hoists are placed within the mine, the long steam pipes from boilers on the surface and the necessity for two operators has made the change from steam to electric drive a foregone conclusion.

The rates for hoist-motor service are commonly included in the general mine charges, but since the maximum demand and total average daily load are readily checked and separated, a flat rate is oftentimes given. Most charges are based on the rating of the motors installed plus the kilowatt-hour consumption.

DRILLS.

Drills in metal mines are almost all operated by compressed air, the electrical drills thus far tried having been unsuccessful. The development of a good electric drill would obviate the trouble caused by the freezing of air lines in cold weather and enable extensions to be made more cheaply and quickly. The compressed air is usually supplied from an air compressor on the surface through an auxiliary tank. The driving of the air compressor by means of an electric motor, automatically controlled by differences in pressure in the receiver, eliminates the necessity for an operator and avoids boiler troubles and danger from fire. Squirrel-cage induction motors are common for the smaller compressors, and motors with external resistance are usually employed on the larger compressors. The compressor load, like that of the hoist, extends over eight hours, and, while intermittent in character, is not subject to stoppages and excessive variations encountered in the operation of electric hoists. The motor installation usually averages 10 hp per 2¼-in. drill installed, the drills requiring about 100 cu. ft. of air per minute at 100 lb. pressure.

Where air storage is possible, the electrical operation of the compressors for mine service is ideal, although many

steam-driven compressors are still in use where steam hoists are retained, one operator attending both. The service for compressors, if not included in the total charge based on readiness to serve plus energy metered, is sometimes rendered on a flat-rate basis of about 40 kw-hr. per drill.

PUMPS.

Pumps are not very common in the metal mines in Colorado, as the latter are usually in mountainous districts where the rainfall is light and the surface drainage and evaporation rapid. Where shafts are sunk to very great depths, multi-stage centrifugal or triplex pumps are installed and are usually geared directly to squirrel-cage motors. In the Cripple Creek district drainage tunnels render the use of motors unnecessary.

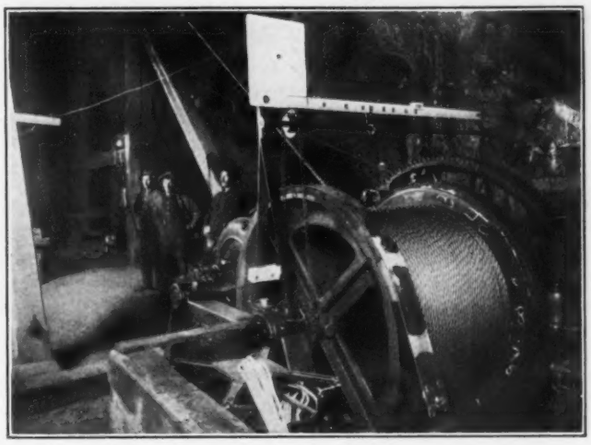


Fig. 2—Mine Hoist Under Ground in Conundrum Mine.

Inasmuch as the pumps, when installed, call for constant twenty-four-hour service, the load is most desirable for central stations, and because of low first cost, low energy charge, non-attendance and minimum rates, electric drive for pumps is desirable from the mine operator's viewpoint. When not installed in conjunction with other machinery, the energy for motor-driven pumps is usually sold on a flat rate, since the size of motor required, gear ratio and demand are readily ascertained when the load is constant.

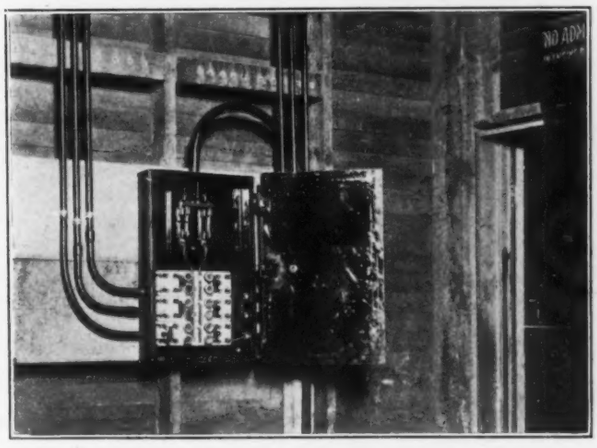


Fig. 3—Wiring in Shaft House, Colburn Mine, Victor, Col.

For this class of work it is usual to install 8 hp per 100 gal. on a 100-ft. head.

FANS.

Since in hilly countries working conditions in extensive mines usually develop natural drafts by combinations of shafts and tunnels, and since dangerous gases are seldom encountered, fans are rarely used. Occasionally, however, carbon dioxide enters workings under certain atmospheric conditions, or other causes may render the installation of fans desirable. With eight-hour shifts it is necessary to run the fans longer in order to free the mines from gas before the arrival of the workmen. The load is otherwise constant, except for the momentary opening of shaft or tunnel bulkheads during shifts. Squirrel-cage induction motors directly connected to the fans are ideal for this service, and are usually started from the mouth of the mine. In the Conundrum Mine at Cripple Creek a 15-hp induction motor, 120 ft. below the surface, is started by a time switch at the head of the shaft four hours before the shift begins.

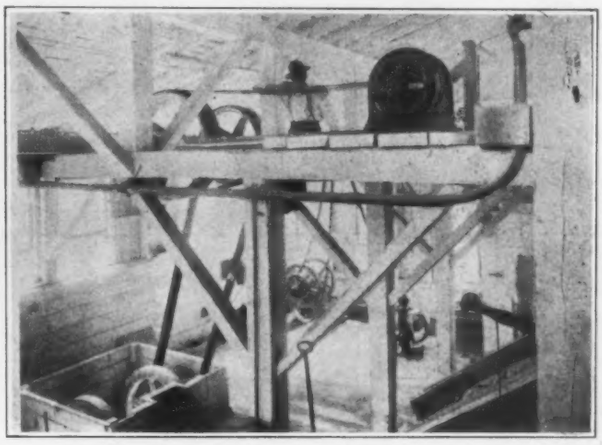


Fig. 4—15-hp Induction Motor Driving 75-Ton Crusher.

The fan load is even in character and lasts from eight to fourteen or more hours a day. The use of motor-driven fans avoids high steam-plant costs, with sometimes prohibitive lengths of steam lines, and makes automatic starting possible, with ready control at various levels. Energy for fan loads is sold on a flat-rate basis.

RAILWAYS.

Mine railways are infrequent in Colorado metal mines, but where used show the usual advantages over hand or mule haulage. The cost per ton of ore delivered from the shaft or tunnel to the mill or dump has not been studied, but the increased output, due to the use of mine railways, is generally recognized, especially where all of the output has to be handled through one outlet. Direct-current series motors are used for this service, the trucks being equipped with two motors, subject to series parallel control. The tension commonly used is 125 volts, and a third-rail system is employed.

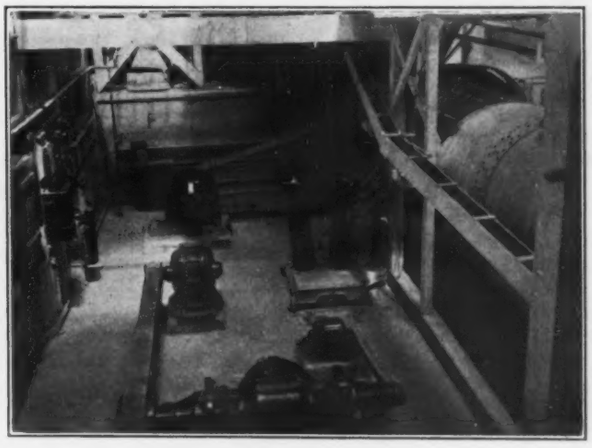


Fig. 5—Interior of Mill at Colburn Mine.

Although a load of this character is not altogether desirable, it is usually sought by central stations, since mines large enough to require railways generally possess ore-treatment plants, and the latter afford constant loads of high load-factor. The rates for service on mine railways are usually based on the rating of the installation, plus the energy consumed, the motor of the motor-generator set

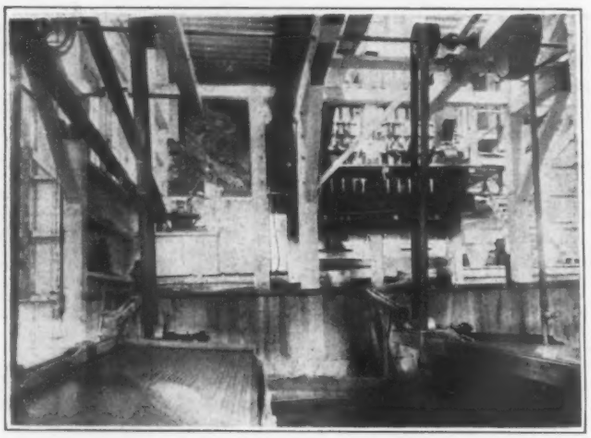


Fig. 6—35-hp Induction Motor Belted to Two Five-Stamp Batteries at Primos Mill, Lakewood.

being considered as part of the installation, chargeable to the railway system.

ILLUMINATION.

The lighting of metal mines offers a small continuous day load of about eight hours' duration. As the lamps are seldom used during mill and town lighting periods and the load is constant, its desirability is recognized. Convenience, safety and generally better illumination recommend electric lighting to miners. In most mining districts the secondaries are grounded in order to safeguard the lives of the miners. Some mines are being wired in well-painted iron conduit with marine fittings; but packing-house cable construction, with porcelain petticoat insulators, and lamps in composition keyless sockets soldered direct to cable wires and with joints well painted, appears to give good life. Although lighting rates are usually included in the charges for the entire mine service, flat rates are not infrequent.

Outdoor transformer installations are commonly made for mines, and even for mills. Choke coils and disconnecting switches are located on the primary circuit, and sometimes horn-gap arresters and oil switches are installed. Primary voltage in the various districts differs, ranging from 6600 volts in the Cripple Creek district and 13,000 volts in Boulder to as high as 24,000 volts. The secondary circuits in all of the districts have a potential of 440 volts, and separate transformers are used for the lamp circuits, or occasionally taps are taken from the 440-volt secondary windings of the main transformers. Although the secondary of the motor circuits is usually grounded as a precautionary measure, this does not obtain in the Cripple Creek district, where it is claimed additional transformer troubles have been traced to this cause. While motors are sometimes rented of the public utility company in new or small mines, the transformers are in all cases owned by the utility company.

MILLS.

This term includes all ore-treatment plants. Wet concentration requires crushers, rolls or stamps, jigs, trommels, shaking tables, tube mills, Chilean mills, sand pumps, driers and melting furnaces, and all of these may be operated electrically. In cyanide treatment, crushers, rolls, tube mills, Chilean mills, trommels, shaking tables, sand and solution pumps, agitators, driers, melting furnaces and various applications of electrolysis are employed, all of which offer fields for electrical application. All of the processes, with the exception of crushing and grinding, are operated in both types of mills with great regularity, since savings of metal content depend on known conditions and these are disturbed by starting and stopping. Elevators, conveyors and railways are incidental to the transportation of ore, crushed ore, concentrates and waste, where the arrangement of the processes makes gravity feed impossible between the consecutive stages. To secure gravity feed mills are customarily built on the steep side hills. Chlorination having been abandoned, the electrical production of chlorine has ceased to be a promising field, and the roasting of ores in revolving metal roasters, so inclined that the ore feeds from the lower end, has also been practically abandoned, so that the cyanide process now predominates.

CRUSHERS.

Crushing is accomplished in jaw or disk crushers, the output of which varies with the size and hardness of the ore, size to which it is crushed, speed of machines and, of course, with duration of operation. Mills supplied from mines near at hand and possessing storage bins can operate crushers practically continuously during mining hours or even longer. The Portland mill crusher at Victor operates sixteen hours a day and consequently offers a good load-factor in its crusher plant and in the mill as a whole. In sampling mills the ore is naturally crushed as it is received from various sources, and the operation is irregular. Hand feed also means irregular operation and the desire to crush the twenty-four-hour output of a mill in from five to eight hours results in a heavy load. The crusher motor is usually belted to the machine and is chosen large enough to meet all the usual irregularities of operation. Much of the time the motor is only partially loaded. Practice varies so that it is impossible to give any definite rule for determining the size of motor. In one large mill a 9-in. by 15-in. crusher for tungsten ore is driven by a 15-hp motor and handles 40 tons in from six to eight hours, grinding it to 2-in. mesh. Usually crushing and grinding loads are combined on a single motor through a short line shaft. Where the grinding is divided among a number of machines and storage is provided between steps, the crusher and grinding load becomes a desirable one from a central-station viewpoint.

Rolls are operated in pairs, each being usually belt-driven with spring compression. One mill with an eight-hour

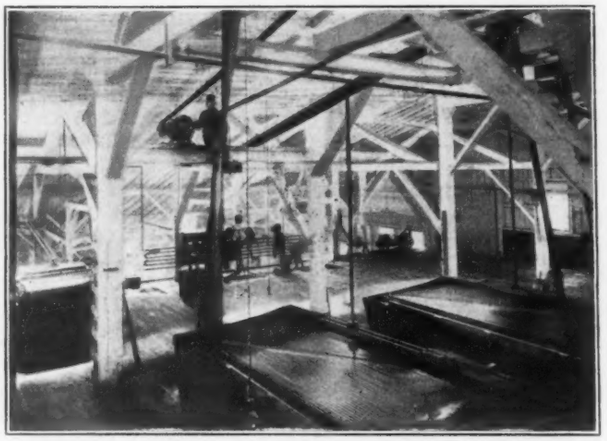


Fig. 7—Wilfrey Tables Belted to 5-hp Induction Motor, Primos Tungsten Mill.

crushing, grinding, trommeling and elevator load of 300 tons is operated by a 100-hp motor belted to a line shaft. For crushing service squirrel-cage induction motors are usually employed, and motors of the external resistance type are employed in large mills. Constancy of speed is desirable, although not so important as in subsequent operations; but ready control is a feature which appeals to mill

operators. In making rates for mills the crusher plant is usually included, although by itself it does not offer an attractive load as ordinarily operated.

MILLS.

Tube mills and Chilean mills both grind ore of from ¼ in. to No. 12 mesh to a fineness ranging from 50 to 200 mesh, so that with correct water dilution the heavier metal particles will be separated from the lighter particles on shaking tables, or the precious metals from their compounds in chemical solutions. The tube mill is a cylinder tilted slightly from the horizontal through which the crushed ore passes and is ground in transit by contact with selected hard pebbles. The ore is fed with sufficient water to wash it to and through the mill, and if the cyanide process is to follow, the water added may also contain cyanides and other chemicals to assist the mechanical separation of metal compounds from the ore and at the same time to begin the chemical treatment.

The Chilean mill is a vertical mill fed at the top and emptied of its contents at the bottom. It usually handles thicker material than a tube mill, and the ore may be wet with water or partly by weak chemical solution as in the case of the tube mill. Both loads are constant and of twenty-four hours' duration. The tube mills are ordinarily belted to the motors and are geared to automatic feeding devices which add more or less water and greater or less ore content, according to the amount of mechanical or chemical action desired. The Chilean mill may be geared to a feeding mechanism; but it is more often fed manually. Both mills revolve at from 30 to 60 r.p.m., the Chilean mill being more often speeded beyond its rating; but in both the output is increased and the product sometimes bettered with increase in speed. Squirrel-cage motors are always employed and of a size suited to the normal load.

From the mill owner's viewpoint, electric drive possesses the advantages of constant speed without watching, easy control and ready change in size or location of motor to suit changing conditions of operation. The load being desirable, the rates for electrical energy are usually low and are always included in the total mill charges.

STAMPS.

Stamps, which are still occasionally employed, usually deliver a less uniform product. Heavily weighted hammers

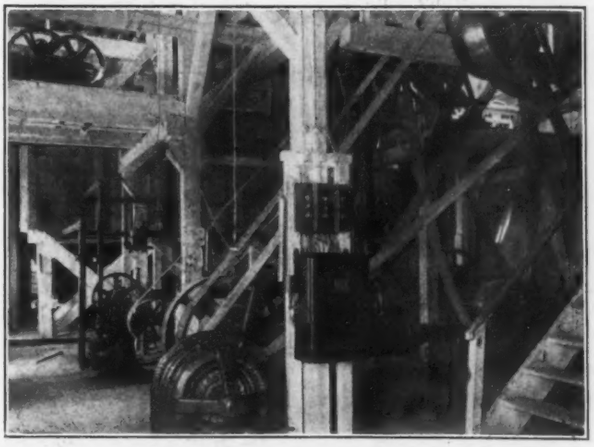


Fig. 8—35-hp Induction Motor Driving Pump and Compressor, Colburn Mill.

operated by cams drop into cups, through which ore is slowly fed by mechanical means. The stamps are usually installed in batteries of five, and the cams are staggered on a countershaft. The ore is fed dry to the stamps in either a coarse or fine state, and the load depends only on the travel of the hammer and its frequency of operation. No definite rule for determining the power demand can be given. The speed ranges from 80 to 100 r.p.m., and the travel from 3 in. to 12 in. In one mill with two five-stamp batteries, operated at 90 r.p.m. and with 6-in. strokes, the demand is 25 hp.

SHAKING TABLES.

Wet concentrating tables are of two principal kinds. In

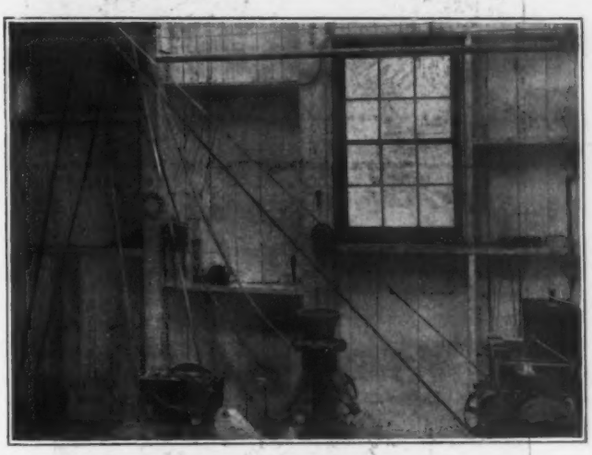


Fig. 9—Sampling and Zinc Feeder Plant Driven by 12-hp Induction Motor, Colburn Mill.

one the "pulp" has water added to it and the coarser particles of the heavy metals are separated from the slime, and in the other, known as slimers and vanners, a canvas rolling over drums catches the heavy metal particles, while the remainder wash over an edge, the "concentrate" being later washed into receptacles as the canvas turns over a drum into a spray. Both kinds of tables operate under practically continuous load, and the nature of the process is such that the demand depends on the rapidity of shaking and not on the amount of pulp passed over the tables. From the mill standpoint electric drive for concentrating tables has all of the advantages of known constant speed, without supervision, and is an ideal load for central stations. At about 240 r.p.m. Wilfrey tables average about 2 hp in demand, Card tables about 2 hp, Monnell slimers about 1 hp and vanners slightly under 1 hp.

JIGS.

Jigs are employed where a saving is to be effected from crushed and rolled ores without reducing them to slimes. After passing through or over trommel screens to exclude the slimes, the coarser particles are fed into jigs, which are U-shaped hydraulic pumps. On one side pistons compress at the rate of from 150 to 200 strokes a minute, and on the other side water rises through perforated plates and agitates all particles in a box above, so as to wash the lighter particles into waste pipes or grinding apparatus and thereby reduce them to slimes. The heavy particles are constantly fed to recovery boxes, and where the ore is free milling this system gives good results in concentration. As jigs are operated continuously, they offer a desirable, even load for central-station circuits. The power requirements vary greatly with variously determined operating conditions, but for ordinary sizes of jigs, speeds and amplitude of the piston throw the demand ranges from 2 hp to 7 hp per jig.

AGITATORS.

Agitators are employed in the cyaniding process to mix the ore slime or larger particles received from tube mills, Chilean mills or other grinders with cyanide and other chemicals. Iron tanks 20 ft. or more in diameter and height are used, and air under low pressure is forced through large metal pipes introduced into the bottom of the tank, causing a general upward movement in the center and a downward movement at the sides of the tank. The air compressors employed for this purpose are operated con-

tinuously twenty-four hours a day. The solution flows from one tank to another, the waste being gradually removed through hoppers at the bottom, and the solution becomes clearer in transit to the filters, after passing through which it receives its final chemical treatment for

Fig. 10—Tilting Furnace with Electrically Driven Blower, Colburn Mill.

the recovery of the metals. The compressor is usually belt-driven from a short line shaft, to which circulating pumps and other apparatus are connected. Owing to the wide divergence in the amount of air required by different mill operators, no general rule for approximating the power demand can be given.

TROMMELS.

Trommels are used for sizing crushed ore. They consist of revolving cylinders covered with screens of various mesh and tilted slightly from the horizontal, ranging in size from 3 ft. in diameter and 5 ft. in length upward. The ore is automatically fed to the upper end of the machine, which in revolving drops the under-size material through screens connected to proper receptacles, and the larger size material is carried through and delivered to further screens or processes. In those plants where the trommels are associated directly with jigs the load is constant, but where the trommel forms part of a crusher plant operating from five to eight hours the load is intermittent. In either event no large variation in the demand is encountered during operation, so that the load is a desirable one from the central-station viewpoint. Trommels are usually belt-driven from shafts to which are also connected crushers and rolls or jigs and mills. The power requirements vary with the speed, which is limited to a range of from 30 to 60 r.p.m. From 1 hp to 1.5 hp is required in a slowly driven 3-ft. x 5-ft. trommel, and from 3 hp to 4 hp is the average demand of a 5-ft. x 9-ft. trommel.

CONVEYORS.

Conveyors, elevators, etc., are installed in mills where required by the relative locations of the machines and sequence of operations. As originally laid out, mills do not require conveying apparatus, but re-processing and re-location of machinery, incident to growth and other additions, render the use of a conveyor system imperative. The loads are not large and the practice is to drive the conveyors from a short line shaft, which also drives the machines with which the conveyors are associated. In large mills portions of the elevating and conveying machinery are driven by separate motors. The load is generally continuous in mill operation but intermittent in crusher plants, and it is obviously impossible to give any approximation of the demand of such a load.

PUMPS.

Besides the centrifugal pumps used for handling water and the weak chemical solutions employed in the cyanide process, sand pumps are used to handle the fine and coarse slimes of the wet concentration process. The pumping loads are usually constant in character and the power requirements depend on the method of operation.

ELECTROLYSIS.

Electrolysis is employed to some extent in connection with the recovery of metals from cyanide solutions. In the Ajax mill at Cripple Creek a 20-hp motor is belted to a 10-volt, 1500-amp generator. Energy from this is fed to baskets having 4-in. by 4-ft. cylindrical graphite anode centers, the surrounding iron forming the cathode, and the baskets are sunk in the weak chemical solution of the agitators to hasten the chemical separation of the metals from the compounds in the ore slimes. Electrolytic methods are also employed in the zinc press treatment for recovering metals from cyanide solutions. Instead of forming zinc compounds and continuously wasting the zinc, the gold-bearing solution is passed between plates spaced so that, with proper flow, the ion travel will theoretically cause all of the gold to be deposited on the iron cathode, whence it may be removed as a precipitate. In the Davis precipitator a semi-circular tank 3 ft. in diameter by 12 ft. long is used to hasten the process. The solution in flowing through the precipitator is intercepted by twenty-four No. 12 gage revolving steel disks, which are perforated to permit the passage of the solution and are connected as cathodes. Anodes consisting of numerous 7/8-in. graphite rods are hung in the solution between the disks. Conditions are so greatly affected by other processes that no general rule for power demand of electrolytic applications can be given.

DRIERS AND FURNACES.

The electrical drying and melting of ores is being introduced to some extent, the drying being effected in brick furnaces located over metal plates, under which heater coils are placed. The precipitate bearing the metals is thus heated to remove moisture, so that the material may be easily shipped or handled. It is necessary to make very low

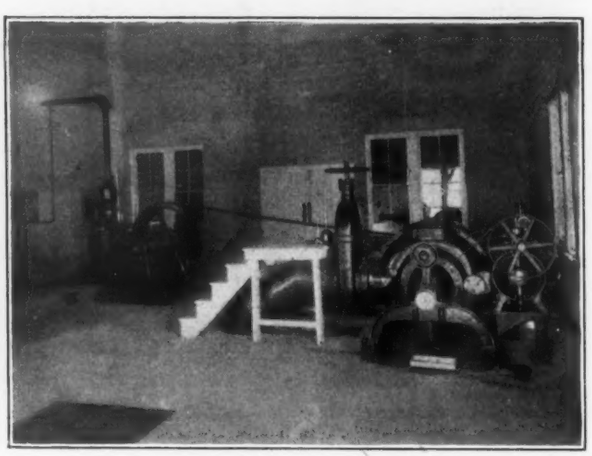


Fig. 11—Interior of Tungsten Mill Power Plant, Nederland.

rates for energy for this work in order that electricity may compete with steam. From 10 kw to 25 kw is required in a mill drying from 15 tons to 30 tons of tungsten precipitate a month. The drying of gold precipitate from cyanide solutions, owing to the small total quantities handled, does

not call for so great a demand. Electric furnaces of the arc type are also occasionally employed to melt gold and silver from their precipitates, although oil-burning, tilting furnaces are in common use. The demand for electric furnaces is large, uneven and cannot be readily fixed, since it depends upon many conditions. The load-factor of the furnace is also very small.

SAMPLING AND ASSAYING.

Sampling and assaying processes are incidental to mill operation. Sampling is done in all crushing plants, a certain percentage of the ore passing through the main crusher being crushed in the sampling crusher and ground in sampling rolls or disk grinder, and the portion of the product thus treated is assayed to ascertain the quality of the ore. The load is intermittent in character and calls only for the employment of small motors or small heaters. When associated with mills the load offers no great change in the general character of the demand.

MACHINE SHOPS.

In connection with all mines and mills, machine shops are to be found, and these offer small day loads of more or less intermittent character. On the whole, the installations are not large enough to affect the load-factor of mills greatly, but oftentimes they improve the load-factor of mine plants.

GENERAL.

From the foregoing it may be seen that mines and mills are entirely different in their load characteristics. Both offer a day load, but the mine load usually reduces to zero before the evening lighting peaks come on. The mill load usually extends over twenty-four hours and is more or less constant, and the combination business, if properly developed, should show a heavy, somewhat uneven day load in which the individual plant peaks are smoothed off by the comparatively small size of any one drive.

INDIVIDUAL MOTOR DRIVE IN NUT AND BOLT FACTORY.

One hundred tons of nuts, bolts, railroad spikes, etc., per day is the capacity output of the new bolt shop of the Inland Steel Company, at Indiana Harbor, Ind. The building itself is 480 ft. long and 120 ft. wide, being divided longi-

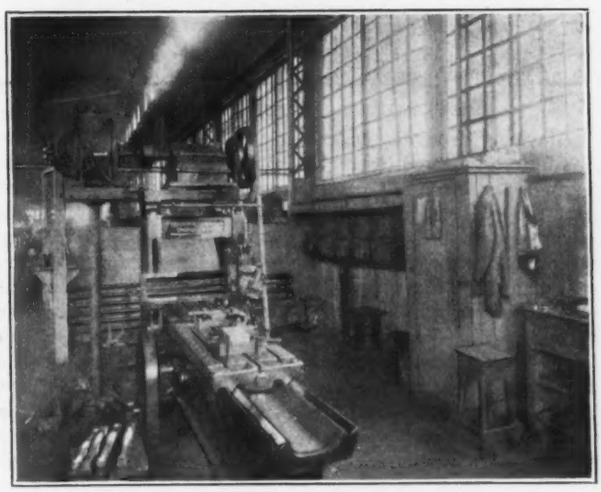


Fig. 1—Motor-Driven Planer with Group of Automatic Starters.

tudinally into an 80-ft. and a 40-ft. bay. The 80-ft. bay, in which are the continuous heating furnaces, is spanned by a 5-ton Alliance crane, while a similar 35-ft. traveler moves the length of the machine bay in which the automatic tools are installed. One end of the structure is given over to a machine shop containing individual motor-driven tools of all kinds, for making plant repairs. The equipment includes lathes, planers, shapers, drills, milling machines, boring mills, etc.

Outside, in the main shop, are the automatic machines

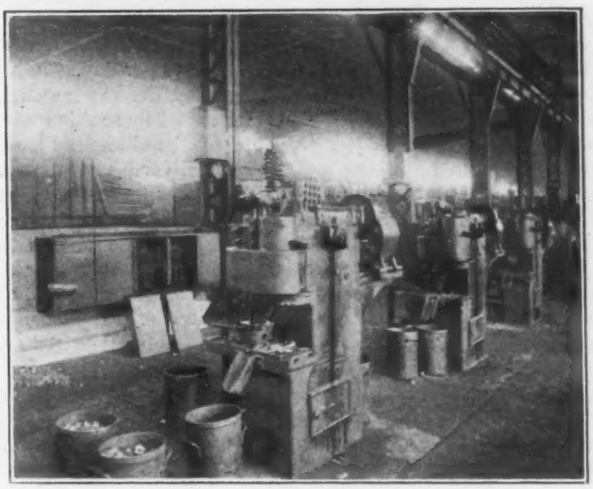


Fig. 2—Automatic Motor-Driven Machines Removing Burrs from Nuts.

which manufacture the nuts, bolts, spikes and other hardware. There are, altogether, fifty-nine of these motors, ranging from 2 hp to 100 hp in rating, all of which are started by Electric Controller & Manufacturing Company's automatic controllers, from push-button switches mounted on the machines. The controllers themselves are grouped in metal boxes on the walls near by, being connected with their respective motors through circuits inclosed in conduit embedded in the floor.

The ingenious principle of these series-coil contactors has already been described in these columns. Between the moving plunger of the switch and the rest of the magnetic circuit are two air-gaps, one always tending to close the switch when any current flows through the coil and the other tending to lock the switch in the open position when the current in the coil exceeds a certain definite adjustable value. When the motor is connected to the line through the coil of the first contactor and the starting resistance the current flowing is sufficient to lock open this contactor. As the motor accelerates the current of course diminishes, and when it has receded to the value at which the contactor is adjusted the moving plunger at once operates, closing certain contacts and short-circuiting a portion of the starting resistance. The rest of the series contactors operates similarly until all of the starting resistance has been short-circuited and the motor is connected directly to the line.

Since the controller switch cannot close until the motor current has fallen to its predetermined value, automatic starting is effected safely and with minimum current in minimum time. The device also permits quick stopping and pre-setting of the motor field resistance, while protecting the equipment against both overload and no-voltage conditions. To start the motor the workman merely pushes the white button on his machine, and to shut it down closes the black button. All precautions of proper acceleration are automatically cared for by the controller switches on the wall opposite. In the box with the controller is also mounted the shunt-field rheostat, where field control is desired.

Probably the most interesting of the automatic machines on the main floor of the bolt shop are the three Youngstown spike machines. The raw stock, delivered at a cherry-red temperature by the Ferguson continuous furnaces, is handed by feed rolls over to vises in the spike machines, in

which it is held while the spike ends are being pointed, cut off at the proper length and then headed by upsetting in a chilled die, each machine finishing eighty-five spikes per minute. Two 75-hp, 220-volt Westinghouse motors, running at 475 r.p.m., are provided to drive these three spike machines, although a single motor suffices during ordinary outputs. Space has been left at the end of the shop for a future installation of two similar machines which will each have an output of 10 tons of finished spikes per day.

In the rivet-heading machines near by the raw stock is cut to length and headed. There are six of these Ajax continuous-feed rivet-headers, capable of handling material from 0.5 in. to 1.5 in. in diameter and delivering 4000 rivets per hour. Each header is driven by a 15-hp Westinghouse motor. The raw stock is heated in six Ferguson continuous furnaces, fired with oil under air blast. These 26-ft. furnaces are capable of pre-heating 1 ton per hour and comprise four combustion chambers in which the oil is burned at the rate of 24 gal. per ton of material. The fuel is pumped by two ¼-hp Westinghouse motors geared to 3.75-in. by 4-in. pumps, which deliver against a head of 15 ft. Blast is provided by two 100-hp motors operating blower fans which move 46,000 cu. ft. of air per minute. After the bolts have been headed they are threaded in the roll-threaders or in the rapid horizontal threaders. The

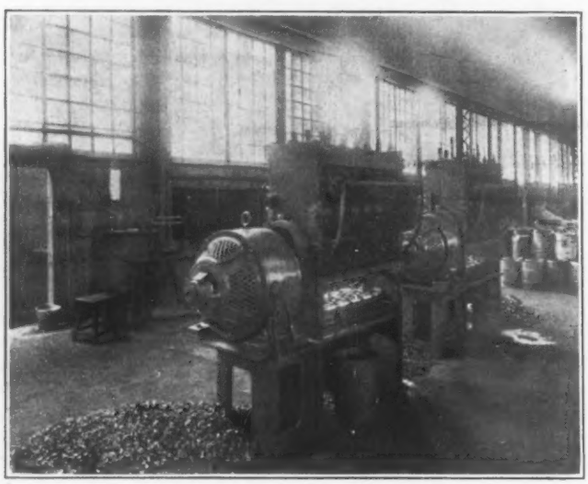


Fig. 3—Semi-Automatic Nut-Tapping Machine Operated by 5-hp Motor.

three Farrel roll-threading machines are gear-driven by 10-hp motors, and the two Acme three-spindle rapid horizontal threaders are run by ¾-hp motors. The threads are rolled cold, material being thrown up from the valley portion to form the raised thread, which is of an outside diameter larger than the original blank bolt.

Four thousand 1-in. nuts can be delivered daily by the four hot-pressed nut machines. After being rough-pressed, the nuts are freed from burrs in a special milling machine and then polished and cleaned in tumblers, 36 in. in diameter and 48 in. long, also motor-driven. Tapping is done by National semi-automatic machines, each comprising a gang of six spindles, which are fed by hand and can be operated separately if desired. These tapping machines are driven by 5-hp Westinghouse motors and have outputs of 950 1-in. nuts per hour.

Thirty-two 500-watt tungsten lamps are employed to light the bolt shop. These units are mounted 25 ft. above the floor, at intervals of 20 ft., in rows 40 ft. apart. One 500-watt lamp thus lights 800 sq. ft. of floor space. During a recent twelve-month period the cost of maintenance and renewals for this shop lighting was $33, little more than $1 per lamp per year. Mr. R. L. McIntosh is chief electrician for the Indiana Harbor Works of the Inland Steel Company.

THE BENEFITS OF WATER-POWER DEVELOPMENT AND ITS RELATIONSHIP TO NAVIGATION IMPROVEMENT.

By James E. Hewes.

In considering the problem of the improvement of river navigation one cannot ignore the importance of control of floods and the conservation of water-power development. These three great problems are so closely interdependent that they must be considered simultaneously. The combined problem is one for a commission to solve, as the writer pointed out in a paper read before the American Electric Railway Association, because in its solution the river and its entire watershed must be considered as a whole.

As the Mississippi navigation improvement, for example, is now being carried on, the river is divided by sections or districts and each district is in charge of an engineering officer of the United States Army, and consequently what work is done in one district has no relation to the work of another district or to the problem as a whole. The work is carried on by methods that change as often as some enterprising senator or congressman can obtain an appropriation, and if the appropriation is exhausted the work stops, and what work is done may or may not aid conditions locally and may actually be detrimental to work in another district. For example, the dams built on the Kanawha and Ohio Rivers have deprived posterity of the benefits of hydroelectric development because they are not of sufficient height. The dams are in many cases only 9 ft. high and cannot be used for hydroelectric development, nor are they of great use in holding back flood waters, because the amount of water they retain on the upstream side is an almost negligible quantity, whereas had they been constructed as high as the Keokuk dam on the Mississippi only one-seventh of the number would have been required and there would have been little difference in the total cost. Then navigation could have been maintained during times of drought and the period of winter navigation would have been greatly increased; larger boats and barges could have been floated and vast bodies of water would have been impounded; the height of the flood crests would have been materially lessened, and the development of approximately 200,000 kw would have been made feasible.

A great deal of time and money has been expended by the government in order to obtain an estimate of the quantity of water flowing down the rivers of the Mississippi watershed, but as yet the collection of data is insufficient to be of much help in the solution of this problem.

PROPOSED METHODS OF CONTROLLING RIVER.

A system of levees to protect the lowlands near the river has been advocated by engineers who consider this the best means of preventing damage done by floods. It is estimated that the sum of money necessary to do this work in the lower waters of the Mississippi will exceed $100,000,000. Other engineers, of wide experience, have stated that the cost of a complete system of adequate levees will exceed the cost of the Panama Canal. However, no complete estimate based upon a scientific analysis of this subject has yet been made. Many engineers have advocated the straightening of the bed of the river as a means to the end. There have been many who advocate impounding the waters of the tributaries of the Mississippi at the mouths of these rivers, thus storing the water for irrigation purposes and hydroelectric development at these points. However, the thing which must precede the adoption of any of these plans is a complete and exhaustive scientific study of the conditions to be met.

The part of this problem of the most concern to public-utility companies is that relating to the saving and impounding of water by means of suitable dams and to insure that the government will not build dams for navigation

improvement which will be inadequate for hydroelectric development. This step is of equal importance to the people of the districts near the dam and on the headwaters and of the lowlands at the mouth of the Mississippi, because in many instances the impounding of a large amount of water on the headwaters of a stream will greatly lessen, and sometimes will prevent, floods, and the releasing of such impounded water in time of drought will improve the navigation of such streams and at the same time will increase the useful hydroelectric output.

As a tentative plan for the co-operation of the government and the public-utility company it has been suggested that the energy obtainable would be worth a certain sum of money to a public-utility company and to the community in which such a development could be made. It would not be profitable for such a company to pay the entire cost of a development sufficiently large to impound enough water to prevent a flood. Since a company could make a profit by distributing the electrical energy from such a development if it paid a certain price per kilowatt-hour for all the electrical energy it distributed and sold, it could pay for the right to distribute such electrical energy, and the money thus derived could be applied on the cost to the government for the development and thus assist in carrying out a true conservation policy. Before the government would enter into such relationship with public-utility corporations, however, its present attitude would have to undergo a change.

The true conservation of the government's water-power sites lies in the use of them by the present generation and not in the saving of them for posterity. All the energy of flowing streams to-day, if sold, would mean that posterity would be just so much richer. Unlike the coal in the mine or the wood in the tree, which can be stored and saved, the energy of the water is forever lost when it has flowed down the river.

Certain parts of this problem may be solved at once without injury to any general scheme that may be decided upon at a later date and without loss of benefits to the community. For instance, that part pertaining to the impounding of water at the headwaters of the streams can be solved by co-operation between the government and the public-utility companies, the result being many valuable developments which could not be accomplished by public-utility companies alone. Desirable results would be obtained immediately if the government could be induced to cease building small dams which cannot be used for the development of electrical energy.

With regard to the future policy of the government program of levee building, attention is called to an address by Mr. Marshall Leighton, of the United States Geological Survey, before the American Reclamation Federation in Chicago. He stated that in the solution of the problem of flood prevention levees, except for certain local conditions, were not adequate or reliable, and that the effect of levees on the Mississippi River was to raise the height of the river, when the levees held, because it is a proved fact that the river banks are not able to hold the water in the river. In other words, the river is too large for its banks, and if the levees had not broken during the floods of last year the damage and the loss of life would have been much greater.

It is proposed to spend $100,000,000 to build levees which will not hold the river. It would be wiser to spend some of this money further up stream and impound the water by dams built on the headwaters and in the tributary rivers than to be compelled to spend a vast sum of money each year to renew the broken levees, and the benefits to the community at large would be greater.

The people living at the navigable headwaters of a river should enjoy the rights to the river as well as those who live at the mouth of the river. If the government spends millions of dollars for building levees at the mouth of the river, a similar sum should be used at other points on the river, provided that equal benefits will thereby accrue.

DESIGN OF PIPING FOR TRANSFORMER OIL, AIR AND COOLING WATER.

By Fred Buch.

ONE of the important problems in power-house design is the oil and cooling-water piping for the transformers, embracing for the oil system the storage tank, oil-treating outfit, the method of connecting up the transformers and the emergency overflows for quickly disposing of burning oil. The compressed-air and vacuum system, which really forms part of the oil system and the cooling-water piping are by no means so complicated, but here too there are some important details not to be overlooked.

OIL SYSTEM.

Transformer oil is used for insulating the coils from each other and from the core, and also to conduct away the heat and transfer it to some cooler medium. The oil is generally brought to the power house in tank cars or in barrels and dumped into a storage reservoir, whence it is taken and subjected to a process designed to eliminate all moisture and matter in suspension. It is then caused to flow into the transformers, where it acts as an insulator and where it is kept at the proper temperature by cooling coils, through which water is passed. The oil is permitted to remain in the transformers until its insulating qualities are impaired so that re-treating becomes necessary, when it is passed either through the storage tank or through the

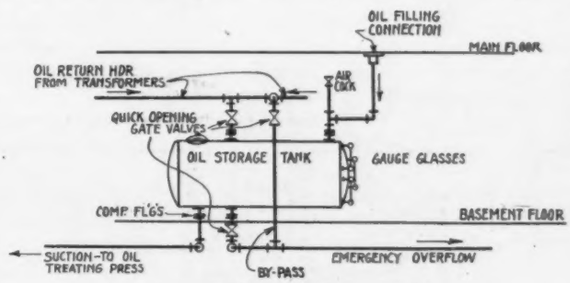


Fig. 1—Piping for Storage Tank.

treating outfit directly and thence again into the transformers. This cycle of operations is gone through whenever necessary until the oil finally becomes useless, when it is discarded and replaced with fresh oil.

In the diagrammatic layout (Fig. 1) the means for getting the oil into the storage tank is shown. The floor fitting suitable for this purpose may be made of cast iron with a brass plug, and a wrench for removing the plug and a funnel fitted with a strainer should be provided. The fitting is made with a flange on top, about 3 in. deep and tapped both top and bottom for 3-in. standard wrought-iron pipe. It is set into the concrete floor, the top of the fitting coming flush with the floor. The funnel is made 14 in. in diameter by 8 in. deep, the lower end being soldered to a 3-in. standard nipple. The body may be made of No. 22 galvanized iron and a screen of 10 by 10 mesh, No. 18 gage, resting in the funnel serves to catch suspended matter. When oil is received in barrels the strainer funnel may be screwed into the fitting and the oil simply dumped; when received on tank cars, however, a 3-in. pipe with a strainer end may be connected from the fitting into the tank car and the oil pumped out by the vacuum system.

STORAGE TANK.

The storage tank should be large enough to hold one and one-half times as much oil as is contained in the largest transformer, as it may become necessary at any time to empty the latter and it would be most undesirable to choke up the system. The cylindrical type of tank shown is preferable, though, of course, any other suitable shape or form may be used. The tank should be provided with

a manhole for cleaning gage glasses covering almost the entire depth of the tank, filling connection, air cock, connection to the treating outfit, return header connection from the transformers, and a large emergency outlet with a quick-opening valve to release the oil in case of fire.

A 3-in. filling connection is ample for any size tank and it is not advisable to use a much smaller pipe on account of the danger of clogging. The air cock, which should be located several feet above the top of the tank, need not be any larger than an inch in diameter, and the size of the connection to the oil-treating outfit is of course fixed by the size of the suction on the pump. Usually a pipe 1.5 in. or 2 in. in diameter will be found ample and will handle the oil as fast as it can be treated if the continuous treating process is resorted to. The return connection from the transformers should be at least an inch larger in diameter than the emergency discharge provided on the transformer, as it serves the purpose of carrying off the burning oil in case of fire or explosion. The pipe should never be less than 4 in. in diameter and should be free from valves and unnecessary bends except at the tank, where a by-pass with quick opening gates should be provided as shown. There should be a good slope in this pipe, and the open end in the case of a water-power plant should discharge into the tailrace. The drain from the bottom of the tank need not be any larger than the return header.

Storage tanks are usually designed for 100-lb. pressure

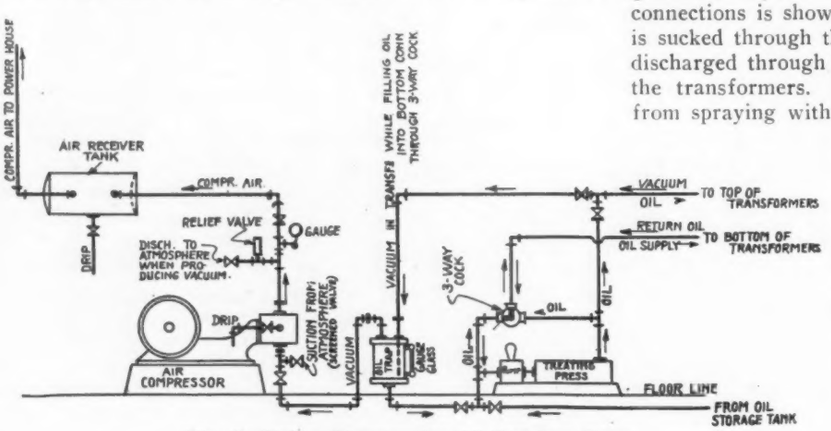


Fig. 2—Piping Diagram for Oil-Treating Press.

per square inch, and the following formula, found in all the handbooks, is recommended for cylindrical tanks: $t = Pr \div S$, where t is the thickness of the shell in inches,

RIVETING DATA FOR TRANSFORMER OIL TANKS.

Thickness of Shell, In.	Diameter of Rivet, In.	Pitch of Rivets, In.	Lap, In.
7/16	1/2	1 1/8	3/4
1/2	5/8	1 1/8	1 1/8
9/16	5/8	1 1/4	1 1/8
5/8	5/8	1 1/2	1 1/2
11/16	5/8	1 3/4	1 1/2
3/4	3/4	2	1 1/2
13/16	3/4	2 1/8	2 1/4
7/8	3/4	2 1/4	2 1/4
15/16	7/8	2 1/2	2 1/2
1	7/8	2 3/4	
1 1/16	7/8	2 3/4	2 1/2
1 1/8	1	3	3

P the pressure in pounds per square inch, S the safe tensile strength of the material, and r the radius of the shell in inches. The dished ends should be 1/16 in. heavier than the shell on account of the bending, and the diameter of the shell may be taken as a radius for the dish. The riveting must be as nearly oil-tight as it is possible to make it, and the accompanying table will be found to give most satisfactory results.

All pipe connections to the tank should be fitted with screwed or flanged unions to make easy removal possible. All flanges should be riveted to the tank, and the tank should be tested hydrostatically and all leaks calked tight before it is painted. The tank should be treated on the outside with a shop coat of red lead and linseed oil, but should not be painted on the inside. The inside should be freed from rust and scale and should be slushed at the shop with a good coat of lubricating oil. All openings should be blanked with wood plugs or otherwise while the tank is in transit to keep out cinders and dirt.

OIL TREATMENT.

Oil may be treated by running it through a filter, dumping into a closed tank and then heating it either electrically or with steam until all moisture is evaporated; but a much better way is to pass it through a treating press. A common form consists of an electrically operated pump and a filter of inclosed blotters. The pump forces the oil through the blotters, the latter soaking up the moisture, and the oil thus treated is discharged into the transformers. A diagrammatic layout of a treating press with all the necessary connections is shown in Fig. 2. New oil in being treated is sucked through the press from the oil-storage tank and discharged through the three-way cock into the bottom of the transformers. This is necessary to prevent the oil from spraying within the transformer, as spraying causes the oil to absorb air and moisture. When re-treating the oil it is sucked through the three-way cock from the bottom of the transformer, forced through the blotters and discharged into the top connection, thus forming a complete circuit and not only preventing a spray but allowing the oil to be treated while the transformer is in operation. The vacuum connection through the last-mentioned pipe is for drying and cleaning out the transformers, and the oil trap serves the purpose of catching the drippings and returning them to the press. The blotters in the press may be removed at any time and dried out for re-use.

Where an elaborate system is not required this form of press may be bought in portable form and carried from one transformer to another as required, thus doing away with the piping. But such a system requires extra help.

TRANSFORMER PIPE CONNECTIONS.

The transformer should be connected up as shown in Fig. 3 and as described in part in the foregoing. Care should be used to get flanged or screwed unions on the outside end of all valves so that a transformer may be easily removed without losing any of the oil. Each transformer tank should have a suitable opening in the cover fitted with a blow-out flange of sheet lead or other like material to act as a safety valve and prevent a dangerous rise of pressure internally. There should also be provided a quick-opening valve in the bottom for draining off the oil and a small test cock so that tests of the oil may be made at regular intervals. Gage glasses and a thermometer with electric alarm should be supplied and large transformers in compartments should be mounted on wheels and set on rails so that they may be pulled out for inspection and repair. Forty-pound rails may be used for transformers weighing up to 10 tons, 45-lb. rails for those weighing from 10 tons to 20 tons, and 60-lb. rails for those weighing 20 tons or more.

No solder or other readily fusible material should be used to hold the tank together or make it oil-tight, and the water cooling coils should be of seamless brass tubing capable of withstanding a hydrostatic pressure of not less than 200 lb. per square inch. The top of the transformer rails should be 2 ft. or 3 ft. above the floor proper so that transformers may be pulled out and set on a transfer truck. Each transformer should be penned off separately in a fireproof chamber with a dam built across the doorway up to the under side of the rails so as to form a receptacle or catch basin for the oil in case of accident. The floor should be fitted with three large openings with strainers, one in the middle and one on each side of the rails, and a large pipe with a good slope should run from these floor drains to a point outside the station. There should be no valve in this pipe and no other drains should connect to it.

The cooling-water connection to the transformer should be fitted with a flow indicator and the return pipe with an open funnel unless the discharge end is free and visible as shown in the diagram. In this case the water is allowed to run to waste through the floor drains, where it can always be seen by the operator and no indicator is necessary.

OIL FILTER

Where oil is treated by heating it should first be filtered through cloth bags before entering the treating tank, and

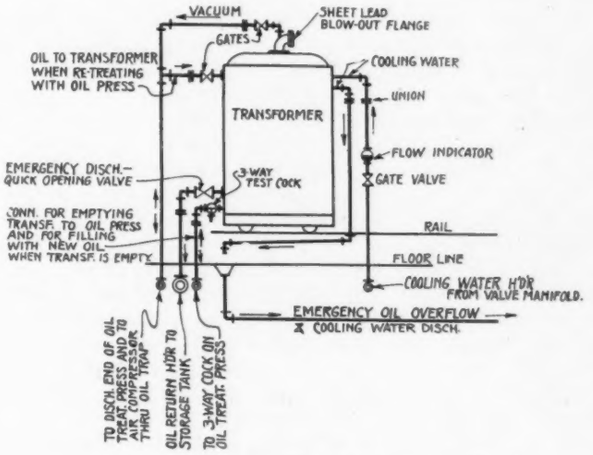

VACUUM
SHEET LEAD BLOW-OUT FLANGE
GATES
OIL TO TRANSFORMER WHEN RE-TREATING WITH OIL PRESS
COOLING WATER
UNION
TRANSFORMER
FLOW INDICATOR
EMERGENCY DISCH.— QUICK OPENING VALVE
3-WAY TEST COCK
GATE VALVE
CONN. FOR EMPTYING TRANSF. TO OIL PRESS AND FOR FILLING WITH NEW OIL WHEN TRANSF. IS EMPTY
RAIL
FLOOR LINE
COOLING WATER H'DR FROM VALVE MANIFOLD.
EMERGENCY OIL OVERFLOW
COOLING WATER DISCH.
TO DISCH. END OF OIL TREAT. PRESS AND AIR TO OIL PRESS THRU OIL TRAP
OIL RETURN H'DR TO STORAGE TANK
TO 3-WAY COCK ON OIL TREAT. PRESS

Fig. 3—Pipe Connections to Transformer.

for this purpose the tank shown in Fig. 4 is provided. This tank may also be used for filtering lubricating oil, but in that case it should be built large enough to hold all the oil in the lubricating system. The tank consists of a pan *A*, in which are punched a number of 3⅛-in. diameter holes. Hard-tin thimbles 3-in. long and 2⅞ in. in diameter at the bottom by 3⅛ in diameter at the top are provided, one for each hole. Bags 10 in. deep are made of canton flannel to fit tightly over the thimbles, and the bags are clamped between the edge of the metal and the thimbles so that when it is desired to remove a bag for cleaning it is necessary only to pull out the thimble. Oil runs into the pan *A* and filters through the bags onto the pan *B* and into the space *C* and then *D*, *E* and *F* respectively, sedimentation of any particles that may have escaped the bags taking place in the compartments. The oil then passes out through pipe *G*. The drain cocks in the bottom are provided for drawing off the sediment. A gage glass should be fitted to the tank and the top made portable for cleaning purposes. The plates forming the narrow compartments in the tank should be riveted in the field, as compartments made in the shop invariably fill up with cinders in transit and on account of the narrow space are almost impossible to clean. An overflow thimble 3 in. or 4 in. high should be fitted in the pan *A*, and where the tank is extensively used a float valve should be provided to shut off the supply automatically when the tank is full. The filter should discharge to the oil-treating tank by gravity.

AIR AND VACUUM SYSTEM.

The method of connecting the air compressor is shown in Fig. 2. Air is used for cleaning the electrical machinery, the spaces around the transformers, the galleries, etc., and

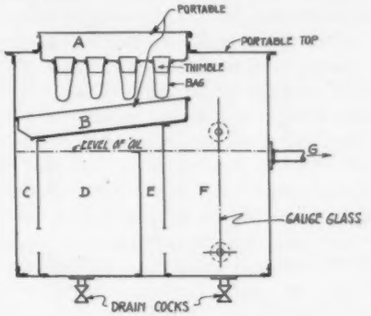


Fig. 4—Coil Filter.

for lifting the transformer oil where the tanks for treating the oil are elevated. The vacuum system is connected into the tops of the transformers through an oil trap as shown in Fig. 2 and is used for cleaning and drying out the transformers. A connection is also run to the bottom of the storage tank by which oil may be sucked from tank cars into the system. The sole purpose of the trap is to prevent oil from getting into the air compressor and to catch all drippings and return them to the oil-treating press. The system shown in the diagram was designed for a power house approximately 35 ft. by 160 ft. and a transformer house 35 ft. by 80 ft. There were five 3750-kva main generators, two exciter generators and five large transformers, each holding 1600 gal. of oil, stepping down the potential from 110,000 volts to 6600 volts. The air compressor used was an Ingersoll-Rand 8-in. by 6-in. horizontal, belt-driven machine, operating at 150 r.p.m., compressing and delivering 50 cu. ft. of free air per minute at 80 lb. pressure. It was required to produce a vacuum in the air receiver of at least 24 in. of mercury when referred to a 30-in. barometer and discharging into the atmosphere.

The air compressor was connected as shown with a 2½-in. screened suction from the atmosphere and a 1½-in. discharge to the air-receiver tank for producing pressure. The 1½-in. discharge was filtted with a pressure gage and a 1-in. relief valve. For vacuum a 2-in. suction was fitted to the top of the oil trap and a 1½-in. discharge to the atmosphere. A 1½-in. cock was placed in the discharge line so that vacuum could be produced in the transformers without raising the pressure in the air-receiver tank. From the oil trap a 1-in. connection was run to the oil line con-

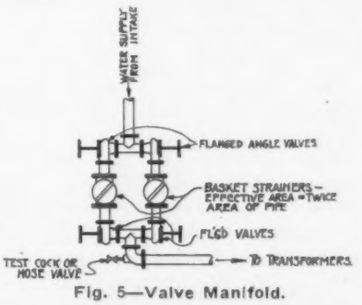

WATER SUPPLY FROM INTAKE
FLANGED ANGLE VALVES
BASKET STRAINERS— EFFECTIVE AREA = TWICE AREA OF PIPE
FL'GD VALVES
TEST COCK OR HOSE VALVE
TO TRANSFORMERS

Fig. 5—Valve Manifold.

necting with the tops of the transformers, and the valves at the transformers were so placed (Fig. 3) that the vacuum would be produced only through the very top of the cover. This is very essential while filling an empty transformer with new oil, as the oil is pumped in slowly through the bottom connection while the air is drawn off through the very top. Drippings that may get into this pipe are caught

by the oil trap as explained before and are returned to the press, so that nothing is wasted. The connection from the bottom of the trap to the treating press and the storage tank was made 1½ in., as that was the size of the pump suction on the press.

The oil trap was made of 12-in. standard wrought-iron pipe 3 ft. long, fitted at the lower end with a standard pipe cap and drilled and tapped for the 1½-in. suction line. The latter was run up 2 in. inside of the trap to avoid catching muck. The cover was made up of a 12-in. standard flange and a 12-in. blind flange, the latter drilled for the 2-in. air compressor suction and the 1-in. connection to the transformers. The 2-in. air compressor suction was run through the cover only far enough to fit a lock nut on each side, while the 1-in. connection from the transformers extended into the trap 18 in. A gage glass 18 in. long was fitted 9 in. above the bottom of the trap.

The air receiver was made of ¼-in. tank steel with 5/16-in. dished ends, 36 in. diameter by 84 in. long. It was fitted with a ¾-in. drip from the bottom, and the inlet and outlet connections were placed on the side as shown. It was tested at the shop under a hydrostatic pressure of 150 lb. per square inch, and all leakage was made tight before painting. The painting consisted of a coat of red lead and linseed oil applied both inside and out. From the air receiver tank a 1¼-in. main was run throughout the power house with 1-in. hose connections wherever required.

COOLING-WATER SYSTEM.

The water for cooling the oil in the transformers may be taken from the penstock intake in a water-power plant and run through the transformers by gravity where there is sufficient head. Where this is not the case pumping must be resorted to, and where the river water is very dirty or full of silt the supply should be taken from another source. The amount of water required for each transformer is determined by the makers of the latter. In Fig. 5 is shown a valve manifold with strainers connected so that one of the strainers may be taken out and thoroughly cleaned while the other filters the water for the cooling system. This manifold is for use where river water is used. A rack or screen is fitted at the intake end and is made accessible for cleaning. Water is piped from this intake to the valve manifold and from the manifold into the system. Each strainer should have twice the effective area of the intake pipe, and the end of the cooling water line should be fitted with a good-size gate valve so that the entire system may be flushed out from time to time. As the cooling water inlet and outlet ends on the transformers are usually located on the front or side of the machines, it is advisable to run the header under the floor or at least under the transformer rails to facilitate the transformer's removal. All other connections to this line should be so arranged that repairs or additions of any kind may be made without interfering with the transformer cooling-water supply.

ELECTRICAL SYMBOLS FOR MINE MAPS.

The 1911 state mining law of Pennsylvania requires that the location of all stationary electrical apparatus forming a part of the electrical system of each bituminous coal mine shall be shown on a map, and that the map shall show, furthermore, the capacity of each motor, generator or transformer and the nature of its duty. Since the passage of this law some discussion has arisen as to the best symbols to employ in carrying out the requirements of the act. The matter has been taken up by the Federal Bureau of Mines, which has just published a ten-page pamphlet on the subject, as Technical Paper 22, entitled "Electrical Symbols for Mine Maps," by Mr. H. H. Clark. The derivation of the symbols proposed is carefully covered, and the bureau will be glad to receive suggestions for changes and additions.

ELECTRICITY IN MINING.

In his presidential address before the South Wales branch of the Association of Mining Electrical Engineers, in its 1912 session, Mr. Sydney F. Walker gave an interesting historical résumé of the course of events relating to the introduction and development of the uses of electricity in the mining industry. The speaker's pioneer experiences with the use of electricity in mines, dating back as far as 1876, were reviewed, and incidents relative to the first uses of electricity in the industry were cited.

The ignition of charges of blasting powder is given as the first operation to be accomplished with the aid of electric energy. Energy at that time was furnished at high voltage from either a static machine or a magneto-generator. The bell signal was the next electric appliance to be given a trial by the still skeptical colliery managers, who then regarded electrical equipment as an expensive experiment. With the advent of the alternating-current lamp at the Paris Exhibition, in 1878, another use of electric energy in mines was immediately recognized, and although the lighting apparatus of that day was very crude, it gave fairly efficient service. The generators were generally of Gramme manufacture and were belted to Tangye steam engines. This combination of machines was also employed in later installations where parallel circuits of incandescent lamps were used.

In regard to the first users of electric energy in mining, the speaker pointed out the discovery by M. Fontaine of the fact that a generator could be run as a motor as being the most important step toward electrical operation of mines. The first installation, a Siemens generator running as a motor and driving a pump, proved to be a very economical plant in comparison to the previous steam-driven equipment. The early installations were all operated on direct current and the upper limit of potential was declared to be 500 volts, owing in a large measure to American railway practice. However, with discovery by Tesla, in 1885, of the possibilities of polyphase operation, coupled with the extended areas which had to be covered in the mines, the lower-voltage direct-current plants began to give way to the high-potential three-phase systems because of their greater efficiency and the ease with which the voltage could be transformed to the required potential.

In conclusion, the speaker dealt with the question of future electrical installations in mines and stated that the high-tension direct-current system, as employed by the Metropolitan Electrical Company at Willesden, seems to be the logical successor of the now prevalent three-phase plants. It was stated that this system entails less loss and gives greater copper economy than any other now in use.

TURBO-ALTERNATOR POWER PLANT FOR A LARGE OFFICE BUILDING.

Non-condensing turbine sets will furnish alternating-current service and steam heating for the new Railway Exchange Building, St. Louis, a ten-story structure now being erected to occupy the entire city block bounded by Locust, Olive, Sixth and Seventh Streets. Sixty-cycle current will be generated at 250 volts and distributed throughout the building as three-wire, 250-125-volt service, neutrals being derived from each of the three 250-volt phases by means of compensators. Three 300-kw rotary converters will furnish direct current to operate the elevators. The plant will be located a block distant from the office building, in the warehouse and shipping department of the Barr & Famous dry goods interests which own the Railway Exchange Building. The latter's basement will thus be available for valuable commercial uses. A tunnel will connect the plant with the office structure, conveying steam pipes

and electric cables, and also providing a runway for removing waste and refuse which can be burned in the plant boilers. Three 750-kw General Electric turbo-alternators, operating at 3600 r.p.m. and generating 250-volt, three-phase energy, will comprise the main units. These are to be non-condensing machines, exhausting into the steam-heating system. At atmospheric exhaust they have a guaranteed steam consumption of not exceeding 31.6 lb. of steam per kw-hr. The lighting load will be supplied from delta connections between the three phases, which will be balanced for the building lighting at the switchboard in the basement. Auto-transformers will provide the three-wire, 250-125-volt neutral points. This equipment, as well as the rotaries for the elevator service, will also be furnished by the General Electric Company. The Comstock company, Chicago, has been awarded the contract for wiring the office building. The Electric Light & Development Company, of St. Louis, will operate the new Barr-Famous Railway Exchange plant.

COST OF PRODUCING ELECTRICAL ENERGY WITH A LOW-PRESSURE STEAM TURBINE.

In an exhaustive paper read before the Electrical Section of the Western Society of Engineers and the Chicago Section of the American Institute of Electrical Engineers at a joint meeting held on Sept. 27, 1911, Mr. Samuel G. Neiler, of Neiler, Rich & Company, consulting engineers, gave an illustrated description of "The Electrical and Mechanical Equipment of the New Passenger Terminal of the Chicago & Northwestern Railway." This large and unusually interesting installation was described in articles printed in the *Electrical World* of Aug. 19 and 26, 1911. The main units of the power plant consist of three vertical cross-compound reciprocating engines rated at 1150 hp each and directly connected to 750-kw, 250-volt direct-current generators. There is also a low-pressure steam turbine and generator unit of 500-kw rating. Exhaust steam for operating this machine is taken directly from the main exhaust header. Additional exhaust steam is also furnished from the air compressors, boiler-feed and vacuum pumps. This low-pressure turbine was designed to be in use practically eight months of the year, the exhaust steam from the engines during the cold winter months being utilized for the heating system.

Mr. Neiler has recently made a reprint of his paper and has taken advantage of the fact to add some information of great interest about the economy of this plant, which is of particular importance owing to the fact that an exhaust-steam turbine is included in the plant, this being perhaps the first generating plant in the country to be designed from the beginning with an exhaust-steam turbo-generator as a part of the equipment. Mr. Neiler's statement about the economy of the plant, referring to the year ended Sept. 1, 1912, is as follows:

"Since writing the above concerning economical results, the plant has been in continuous operation for a period of over twelve months. It has been possible during this time to determine with accuracy the amount of fuel and attendance, including upkeep, which is directly chargeable to each portion of the plant, and from carefully kept records the railway engineers have computed the actual cost to produce and deliver to the switchboard a unit of electrical energy.

"During this period the average monthly kilowatt-hours generated by the plant have been 385,000 or at a yearly rate of 4,620,000 kw-hr. The cost of producing and delivering at the switchboard during the winter months or heating season was 0.14 cent per kw-hr., while throughout the summer months, the cost was 0.445 cent per kw-hr.

"These figures of 0.14 cent and 0.445 cent per kw-hr. are the result of most careful analysis of operating cost and include all items of expense such as fuel, labor, oil, waste, supplies and repairs but do not cover the item of interest on the investment, although during the winter months credit is taken for the cost of heating.

"With seven months of winter and five months of summer, the average cost over the year, based on the present plant output, would be but 0.267 cent per kw-hr.

"The railway requirements are such that in any event a boiler plant and certain apparatus and machinery would be required for providing service of varied character for the terminal station. The items of cost have been divided by the railway company, and that part of the investment amounting to $319,800 is that portion of the whole which is directly chargeable to the isolated plant—that is, the additional boilers installed to meet future electrical requirements; the complete engine and generator equipment with foundations; the switchboard and electrical work in connection therewith, together with that part of the building required for housing the isolated plant.

"The railway company allows 11 per cent to cover interest, depreciation, insurance and taxes on the investment for machinery, apparatus and transmission.

"For purposes of this paper we have allowed the same percentage on the power house, machinery, foundations and items of a similar nature. The total fixed charge, therefore, of 11 per cent on $319,800 per kw-hr., with present yearly production of 4,620,000 kw-hr., is 0.761 cent. This is loading considerable on the present kilowatt output—first, because the 11 per cent on the cost of the building and foundations is large, and, second, because the present kilowatt output is not what is to be eventually produced, as the plant is designed to care for more than double this amount. The total yearly charge on this investment is made against the present kilowatt-hour production.

"Under the present conditions of operation, we have a total cost of 1.028 cent per kw-hr., this item including all fixed charges upon the investment incident to the isolated plant, all labor, fuel, oil, waste, supplies and repairs, including water.

"The total overhead charges on the investment as allowed for the power house building and equipment, including transmission, installed for isolated plant, will remain as the fixed charge even when the kilowatt output is doubled. Therefore, when the total load on the plant reaches 8,000,000 kw-hr. per year, the fixed charge will be reduced to 0.439 cent per kilowatt-hour, while the operating cost which now averages 0.267 cent will be increased only by the cost of fuel and water and removal of ashes, which would make the cost per kilowatt-hour for producing at the rate of 8,000,000 kw-hr. per year 0.386 cent per kilowatt-hour, or a total cost of 0.825 cent per kw-hr.

"During the summer of 1912 some of the unassigned space under the tracks has been utilized for railway department purposes, and additional heating and ventilation, together with light and power service, are called for.

"As a matter of interest, the nature and extent of the various classes of service supplied from the plant are herewith given for the month of July, 1912: The plant produced 427,700 kw-hr. Thirty-eight million cubic feet of free air was compressed to 100-lb. pressure. The elevator pumps used on an average about 35 hp. The refrigerating plant averaged about 35 tons of refrigeration. All steam was furnished for cooking and for the heating of water. To produce the above, 56 tons of No. 5 washed screenings was burned under the boilers. The market price of this coal is $1.27 per ton. It cost the railway company 82 cents at the mines and the freight charge is 45 cents.

"Charging all items of fuel, labor, supplies and water for the above service directly to the kilowatt-hour production, the cost per kilowatt-hour delivered to the switchboard is 0.93 cent, and this during a month when no heating was required."

METHODS OF BURNING ANTHRACITE COALDUST.

By William Kavanagh.

As a matter of economy it sometimes becomes necessary to employ the dust of anthracite coal as a means of producing heat, and when this condition arises special means must be employed for firing the coal. Probably the most common method employed in this country is that of mixing the dust in some rather definite proportion with bituminous coal. Another method requiring special conditions is encountered when the coaldust is injected into a furnace which is maintained at a high temperature. Where it is desirable not to use any bituminous coal at all the dust is sometimes mixed with a small grade of hard coal and burned under a forced draft. Although briquetting is not yet practised to any great extent in the United States, this method of using coaldust has been widely employed in foreign countries, tar, resin or clay being generally used as a binder.

The usual practice when burning anthracite dust in connection with bituminous coal is to use a certain number of barrowfuls of dust with a given amount of soft coal, the proportions used being varied in different places and depending almost entirely on the experience of the fireman or engineer. Where the boilers are hand-fired two or three barrowfuls of soft coal are dumped on the boiler-room floor and over this is spread one or two barrowfuls of dust, the shoveling of the mixture into the furnace being depended upon to form a more intimate union of the different grades of coal. In some cases water is sprayed over the mixture before it is fed to the furnace. There is no hard and fast rule as to the amount of water to use in wetting down the pile of dust, but it will be found that the mixture when wetted before being fired is better enabled to hold a lump shape, and this permits coking, which produces a more favorable condition for burning the dust. Whenever the mixture is fed to the furnace dry there is little tendency toward coking; hence a smothered fire is produced and poor combustion is the result. It is evident therefore that the object of wetting the dust is to produce a lump formation which will facilitate coking. The best proportion of dust to use with soft coal is one that will effect a rapid dissipation of smoke and at the same time maintain satisfactory steam pressure.

For example, if one barrowful of soft coal to two of dust is tried and difficulty is found in keeping up the steam pressure, the proportion should be changed and two barrowfuls of soft coal to three of dust should be tried. In this way the proportion that will best suit the furnace and draft may be ascertained. Natural draft is the best to employ, and where a strong draft is used a greater proportion of hard-coal dust can be used in the mixture.

Another very effective method which is employed to burn hard-coal dust and eliminate smoke may be called the "separated method." With this plan the different coals are not mixed until they are placed in the furnace and then the dust and soft coal are fed in layers. In order to operate this system of burning dust and soft coal, the furnace is cleared of all ashes and a bed of soft coal (preferably lumps) is laid on the grate bars to a depth which is proportional to the draft, the average depth of this lump bed being 3 in. or 4 in. When this bed becomes incandescent a layer of wet coaldust is evenly spread over the fire, and when the flames appear on the surface of the dust a layer of wet soft coal is evenly spread over the surface of the dust, and in this manner the layers of coal are alternated, the last layer being one of wet coaldust.

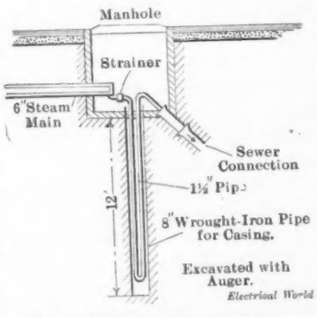
If the system of firing just described is continued until a very heavy fire is built, no more firing will be necessary during the greater portion of the day. In order to have the alternate layers of sufficient thickness it is necessary to begin firing several hours before steam will be demanded from the boiler. Where steam is maintained constantly no difficulty will be met in using the "separated method," and with this system the firemen have the greater portion of the day for themselves, since their only duty consists in occasionally plugging an "air hole." When banking time arrives little ash will be found, as the mass of coal is burned to a honeycomb and can easily be pushed back in preparation for banking. There will be practically no clinker and the amount of ash obtained from a twelve-hour run with a grate surface of 30 sq. ft. will not exceed four ordinary ash cans full. This small accumulation of ash may appear strange to those not conversant with this system of firing, but on reflection it will be seen that the honeycombed mass is practically all coke and the most economical plan is to use it again. It should be mentioned that the first layer of soft coal is fired dry, but that afterward both coals are wetted before they are fired. This method of firing soft coal will be found satisfactory in cities and towns where stringent anti-smoke laws are in force.

The clay used for briquetting hard coal is usually yellow or dark brown in color and is free from gravel or sand. In preparation for mixing with the coaldust the clay is wetted and rolled or "walked" into a pasty mass on a large flagstone. A bed of the pasty clay is then spread on a level surface and over the clay a layer of hard-coal dust is placed; the dust is then rolled into the clay and the mixture made level to receive more clay and coal. These alternate applications of clay and dust are continued until the mass assumes the desired proportions. The mixture is said to be "ripe" for briquetting when the color of the clay has vanished and the entire mass appears black, and when it has reached this condition it is spread out in a bed varying in thickness from 2 in. to 6 in. and the briquettes are then cut in any desired form and put to dry, preferably by sun heat.

Where labor is cheaper than machinery, briquetting is sometimes done by hand. After the mixture is "walked" the mass is shoveled into a heap and persons are employed to form the briquettes by hand. These small briquettes formed in this manner are called "bums," and after being dried they are stored away for steaming purposes. When the "bums" or briquettes are dry they will stand a considerable amount of rough handling before losing their shape and can be fired in the same way as furnace coal.

REPLACING MANHOLE TRAPS WITH WATER SEALS.

The Canton (Ill.) Gas & Electric Company has installed several 12-ft. water seals in the manholes of its steam-heating system to take the place of condensation traps formerly used. The seals are cheaper to build and, being non-mechanical, are simpler in operation, making them thoroughly dependable.



Water Seal Used to Replace Manhole Steam Trap.

From the bottom of the manhole, a well shaft 12-ft. deep is bored with a large auger and then cased in with a length of 8-in. wrought-iron pipe. The seal loop is formed of 1-in. or 1.5-in. pipe, one end being tapped to the 6-in. steam main through a strainer. At its other end the seal is led into the manhole sewer connection. A back-head of 3 lb. to 4 lb. pressure at all times is assured by the 12-ft. water column. This method of installing water seals for handling the steam condensation was resorted to by Mr. E. H. Negley, manager of the Canton company, after experiencing trouble with traps which became clogged and refused to work.

Central Station
Management, Policies and Commercial Methods

MR. BYLLESBY ON RATES AND RELATIONS WITH THE PUBLIC.

On the occasion of a recent interview reported in the Minneapolis *Tribune* Mr. Henry M. Byllesby, president of H. M. Byllesby & Company, which controls the Minneapolis General Electric Company, was quoted as saying that he had no definite information in relation to the matter of rates at the present time but that the people of Minneapolis could be certain that they would receive absolutely fair treatment. According to the newspaper, Mr. Byllesby continued: "I wish to state emphatically that the consumer element has at least a fully equitable representation in every step of the complicated calculations which are now being pushed to a conclusion. Starting years ago with the theory that no public-utility company could possibly be successful if operated selfishly, we have come, through years of experience, to a definite doctrine and practice that the public is our partner." Mr. Byllesby declared further that all necessary betterments would be made from time to time and that the Minneapolis company would be kept where it is now—in the front rank of public-utility corporations.

CO-OPERATIVE STATIONS IN RURAL DISTRICTS.

Germany, Sweden and Denmark possess a number of co-operative electrical-supply undertakings successfully managed by farmers, Denmark alone, with a population of 2,500,000, having about thirty. In the accompanying table the cost of construction, running expense, income and other data of twenty-one of these Danish stations are given. It will be noticed from this table that by charging the prevailing Danish central-station rate of 11 cents per kw-hr. for lighting and 5.5 cents per kw-hr. for motor service these co-operative plants earn 9.8 per cent on the capital invested. Naturally, it is only in rural districts remote from other central-station circuits that such undertakings thrive. Where transmission lines traverse a district farmers along the right-of-way not infrequently form co-operative distribution companies which buy high-tension energy from the central-station company and transform it in privately owned substations for rural distribution.

In planning a co-operative system the promoters canvass the surrounding country to ascertain the attitude of their neighbors toward such a scheme and also the possible lighting and motor load that can be expected. By this means the size of the station is determined. It has been the practice to apportion the stock among the consumers according to their connected loads, one share being allotted for each incandescent lamp and ten shares for each horse-power in motors. Thus, if the estimated cost be $6,000 and the connected load 500 lamps and 70 hp in motors, 1200 shares are issued. Usually the necessary capital is furnished by a banker, each co-partner giving a note for his share of the capital. In this way no actual monetary outlay is made by the owners and the obligations are met through a sinking fund. The property consists of a power station or transformer station, distribution lines and meters. Wiring of premises is also done, and lamps and motor installations are made, by the central-station company, the cost of which is paid to the company in instalments within a period of five years. This has proved to be a great inducement, particularly to small farmers. Small motors of from 0.5 hp to 5 hp for pumping, feed cutting, milking machines, etc., are bought by each farmer, while larger motors for threshing, stone cutting, mill grinding, etc., are usually bought by a group of farmers and are permanently mounted on cars so as to be easily transported from one farm to another.

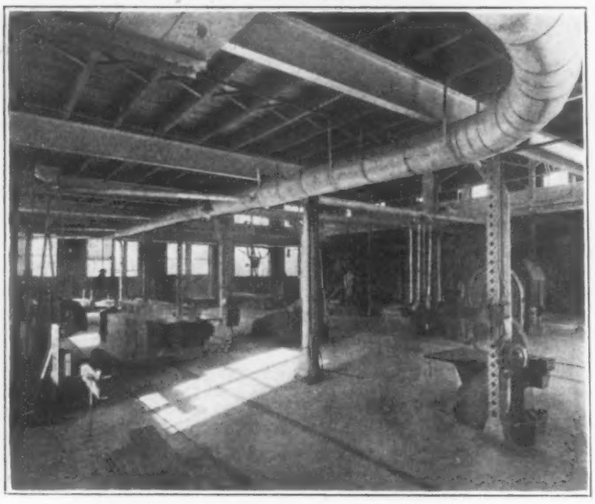
In the European countries mentioned the farmer readily accepts modern improvements and appliances which facilitate rational cultivation of his property, and the advantages afforded by electricity are very evident. This interest is growing, largely on account of the scarcity of farm help.

DATA FOR TWENTY-ONE RURAL SUBSTATIONS IN DENMARK.

GENERATING STATION.					CONNECTED.				INCOME, DOLLARS.								RATES IN CENTS.	
Motive Power.	Rating in Hp.	Total Cost in Dollars.	Cost of Distribution System (Included in Total Cost).	Cost per Incandescent Lamp.	Number of Consumers.	Number of Lamps.	Number of Motors.	Total Hp.	For Lighting Load.	For Motor Load.	Meter Rent and Miscellaneous.	Average per Lamp.	Average per Motor.	Expenses: Wages, Fuel, Etc.	Interest, Depreciation, Sinking Fund.	Net Profit in Per Cent on Capital.	Lighting.	Motor Service.
Steam	.....	1700	.....	7.00	11	245	4	10	780	158	.....	....	....	376	....	....	11	5.5
Gas	15	4600	.....	17.90	13	270	14	43	....	....	.....	....	....	243	....	....	11	5.5
Gas	12	3050	.....	10.80	9	279	7	14	182	183	90	0.66	13	375	80	2.7	11	5.5
Gas	18	2850	270	7.30	18	390	2	2	350	24	13.50	0.90	8.10	132	250	9.1	11	5.5
Steam / Wind	10 / 8	2600	515	6.50	41	400	2	4	460	81	.....	1.22	20	178	375	13.9	11	5.5
Oil / Wind	10 / 10	5450	.....	10.50	42	520	3	7	815	37	96	1.60	5.35	345	700	11.1	11	5.5
Oil	28	3600	555	6.50	63	553	6	12	790	31	121	1.40	2.60	....	465	12.9	11	5.5
Gas	27	6250	820	10.50	50	600	5	10	....	....	.....	....	....	....	....	....	11	5.5
Gas	28	5650	790	9.00	21	625	16	50	....	....	.....	....	....	....	....	....	11	5.5
Oil	34	7900	830	12.00	49	650	13	50	1300	450	27	1.45	8.90	450	1000	13.5	11	5.5
Gas / Wind	10 / 28	8300	780	11.00	56	750	9	26	700	18	190	0.93	0.69	152	700	8.3	11	5.5
Gas	30	7500	1650	9.40	34	800	15	18	....	....	.....	....	....	....	....	....	11	5.5
Gas	22	6225	2430	7.80	60	800	10	20	....	....	.....	....	....	166	....	....	11	5.5
Oil	25	6800	1000	8.40	70	800	13	40	1250	165	100	1.55	4.15	315	1100	10.3	11	5.5
Steam	75	7450	.....	8.40	50	900	....	....	1460	154	162	....	....	775	850	11.6	11	5.5
Gas	28	9100	3000	10.00	50	900	20	64	....	....	.....	....	....	....	....	....	11	5.5
Oil	28	9050	1265	10.00	64	905	11	41	940	200	75	1.02	....	590	625	6.9	11	5.5
Gas	28	7600	1120	7.60	70	1000	6	30	....	....	.....	....	....	....	....	....	11	5.5
Oil	34	10800	1840	10.80	82	1000	9	32	....	....	.....	....	....	....	....	....	11	5.5
Oil	52	15600	5150	13.00	60	1200	24	80	....	....	.....	....	....	460	....	....	11	5.5
Gas	20	7300	.....	6.20	80	1200	8	20	780	156	146	60	7.95	610	475	6.6	11	5.5

INDIVIDUAL DRIVE IN WOOD SHOP.

The simplicity and convenience of individual motor drive is well illustrated by the accompanying view of the new woodworking shop of the Omaha & Council Bluffs Railway Company at Omaha, Neb. All of the various machines, including planers, shapers, band-saws, circular saws, molding cutters, etc., are separately driven by short belts from



Individual Motor Drive in Wood Shop.

motors mounted near by. This arrangement has considerably simplified and cheapened the type of building construction necessary, as compared with that which would have been required for overhead belting. Use of compact self-contained drives has also resulted in less elaborate guards about the belts, moving pulleys, etc., as stipulated by the factory ordinances.

Sawdust and shavings are removed from each machine by a system of exhaust pipes operated in connection with a motor-driven suction fan. To rid the room of sweepings, several down-spouts extend to the floor level, ending in flared valves. The attendant sweeps the sawdust and shavings up to these openings, opens the valves, and then the debris is whisked up the pipe and out of doors into the sawdust pile.

GRADED INSTRUCTION IN RATE-MAKING AND RATE APPLICATION.

The Union Electric Light & Power Company, of St. Louis, has organized a school to train employees in its sales department in the practical aspects of making rates for electrical energy. The men seem to be pleased with the idea and have entered into the plan with considerable enthusiasm. The school is divided into three classes, which meet every alternate Saturday afternoon.

Class 1 is the largest, with about fifty-eight members. It is composed of those who do not thoroughly understand the question of rates, motor applications, etc. Class 2 is for members who have a better understanding of the philosophy and practical application of rates but who desire preliminary information relative to motor applications, the application of rates to large installations of mixed lighting and motor service and illuminating engineering. Class 3 is the most advanced, and here the discussion of rate making, with its application to large installations of all kinds, is taken up. In this class also such other subjects are discussed as the motor requirements of various classes of industrial plants, the workings of internal-combustion engines, steam engines, etc. A student will advance from one class to another when, in the opinion of the teacher, he has absorbed all the information provided in the class in which he started and, furthermore, is able to demonstrate the possession of this knowledge by blackboard demonstrations before the class, the teacher acting as the critic.

ELECTRIC IRON AS FACTOR IN HOUSE WIRING.

Aside from its value as a day-load builder, the electric iron is not to be overlooked as a factor in getting wiring installed in old houses into which iron users move from premises equipped for electricity. Usually the tenant who has been accustomed to electrical conveniences chooses a new location similarly equipped, thus reducing the number of wired houses vacant. But if the new home is not wired the idle electric iron serves as a constant reminder to have service installed, so that in either case the central station profits. In fact, certain utility managers feel that they can forego the ordinary selling profit, and even the income from the irons, in order to get the devices into the hands of the public. For the electric iron, once used, seems to be pretty good insurance that "once a customer, always a customer."

GETTING LANDLORDS TO WIRE RENTED PROPERTY.

The Lawrence (Kan.) Railway & Light Company has been directing a campaign at owners of rental property which remains unwired, seeking to show landlords that they will profit from such investment to better advantage than from any other outlay they can make. Besides urging the phrase "Renting signs come out when electric light goes in," the company makes capital of the point that the

Post Card Mailed to Owners of Unwired Rental Property.

tenant who insists on having electricity is usually of the class which will take best care of rented property. Electrically lighted houses sell at higher prices and rent more quickly than those not equipped with electricity. Herewith is reproduced a post card the Lawrence company has mailed to a number of owners of rental property, attacking the problem from a humorous standpoint.

STIMULATING INTEREST IN TUNGSTEN LAMPS.

The Consolidated Gas, Electric Light & Power Company of Baltimore has adopted a rather novel method of impressing the public with the merits of the tungsten lamp. The company is at present conducting a prize contest for the best answers of 100 words or less to the question, "Why will a 48-cp, 60-watt tungsten lamp, properly placed with a suitable reflector in a kitchen, reduce the cost of living?" For the best answer a cash prize of $10 will be given and for each of the three next best answers ten 60-watt tungsten lamps will be given. The contest will close Dec. 10 and notice has gone out with each consumer's bill.

CENTRAL-STATION DISPLAY ROOM AT YOUNGSTOWN, OHIO.

The Consolidated Gas & Electric Company of Youngstown, Ohio, recently entered the business of retailing electrical energy-consuming devices and opened a very attractive electric shop in the heart of the business and shopping district.

The display room is richly but not too gorgeously furnished and occupies a space of approximately 3000 sq. ft. on one of the most prominent corners of the city. Show windows, with a depth of from 5 ft. to 8 ft., provide a generous space for the display of electrical devices, including portable electric lamps. These windows are arranged in sections. One is given over to motor-driven household articles such as washing, ironing and sewing machines. Another shows a large assortment of heating and cooking appliances, and then come dry batteries for flashlights and ignition. Next to these there is a display of forge blowers, suction and residence-type electric fans, and, last but not least, an entire section is given over to the wiring department for the display of the most up-to-date fixtures and fittings.

A large spectacular flashing sign on the building is operated by a nickel-plated flasher, inclosed in a plate-glass case, also in the window, which arouses comment and

Fig. 1—Exterior of Electric Shop, Youngstown, Ohio.

interest. In the center of the display room a circular marble-faced display counter is an unusually attractive feature, owing to its originality and possibilities as a center for demonstrations of the articles on display. An installation of cashiers' cages has made it possible for all electric light and gas bills to be paid at the electric shop; also, by arrangement with the Republic Railway & Light Company, street-railway tickets for all local lines are sold from the ticket window especially built for that purpose.

All of this brings people in contact with electrically operated devices for the simplification of housework. In the basement will be located a large commercial display covering motor-driven ice-making and refrigerating

Fig. 2—Section Devoted to Ornamental Lamps at the Electric Shop, Youngstown, Ohio.

machines, buzz saws and band saws and planers, electric hoists, etc., with competent men in charge. Taken as a whole, this electric shop is one of the most complete of its kind in the country. The company caters to all trade within a radius of 20 miles along its distribution lines.

SALE OF FLATIRONS AT A FAIR.

Mr. R. E. Flower, manager of the new-business department of the Mobile (Ala.) Electric Company, is of the opinion that the exhibit of an electric service company at a fair may be made to pay for itself through sales of electrical appliances. He demonstrated this belief during the Mobile and Gulf Coast Tropical Fair, which ended recently after lasting a week. At this show the Mobile Electric Company concentrated its effort upon the sale and display of electric flatirons. During five days 162 irons were sold, and although the price was reduced the transactions yielded a snug profit over all expenses.

SALE OF ELECTRICAL APPLIANCES FOR REGULAR LAMP CIRCUITS AND THEIR EFFECT ON LOAD AND INCOME.

By S. M. Kennedy.

Much has been said and written during the past five years concerning the value of electrical appliances to the central station and the efforts made by companies to advertise their advantages and stimulate their use. Many excellent plans have been adopted in various cities, and usually satisfactory results have been reported. Perhaps no company in the United States has been more aggressive in this department than the Southern California Edison Company, and an outline of the methods employed and results obtained by this company during the past year may be of general interest.

The earlier methods adopted by the Edison company to have its consumers use the various electrical appliances adapted for domestic purposes resulted in a very considerable number being installed prior to the year 1909. These earlier efforts were confined mostly to flatirons. The company was liberal in its offers to put irons out on trial, to sell on the instalment plan and to loan the irons for indefinite periods, provided that the appliances were used by consumers.

However, about three years ago the company decided that the seed had been sown and that the interest and demand were such that the day of "trials" and "loans" had passed and that thenceforward all appliances put out should be on the basis of straight sales. The selling of these appliances was not to be carried on by spurts or so-called campaigns, but was to be a continuous performance, just as in the other departments of the company for the selling of energy for light and industrial purposes.

Appliance Installation Record

Sec. 1 East 23rd Street #1

NAME	Street No.	Irons	Toaster	Percolator	Stove	Water Heater	Radiators	Heating Pad	Miscl
Jones A.W.	110	/	/						
Marks C.S.	112	//						/	
Sickler H.	113	/		/	/				
Judson A.C.	115		/			/			
Landers J.	114	/						/	
Staley J.J.	116	/	/	/					
Bacon E.B.	117			/					Wash mach.
Rice J.R.	118	/		/					
Jacobs L.J.	121	/	/						
Henderson H.J.	129	/		/				/	
Smith H.G.	132		/						
Sanders H.B.	134	/							
Jorgensen John	135	/	/						
Woodruff M.A.	136	//		/					
Jamison P.T.	138	/							
Decraduff Geo.	140								
Fenton James	137	/		/					
Kinney Paul	139	/	/						
Hampton H.J.	141	/							
Irving Henry	142		/		/				
McKitrick J.C.	145	/							
Lyons Ben	147	/		/				/	
Hinton D.M.	146	/							
March R.N.	151	/	/						

Fig. 1—Card Record.

KINDS OF APPLIANCES SOLD.

The experience of those interested in this work demonstrated that it was not advisable to handle appliances which had not been fully tested and proved to be satisfactory in the great essentials—namely, consumption, efficiency and durability. If there were a doubt about any make or type, the company could not afford to "get behind" such an appliance and be the means of distributing an article which would cause dissatisfaction to the consumer and constant trouble to the company. This was the first great consideration. The next consideration was to push appliances which would be used more or less constantly and not to waste efforts on energy-consuming devices the energy consumption of which was small and the use of which was irregular. The third consideration was to obtain appliances which were not only popular, efficient, durable and likely to be regularly in use, but also of a consumption not to exceed 6 amp. the limit fixed by the authorities for lamp-socket installations.

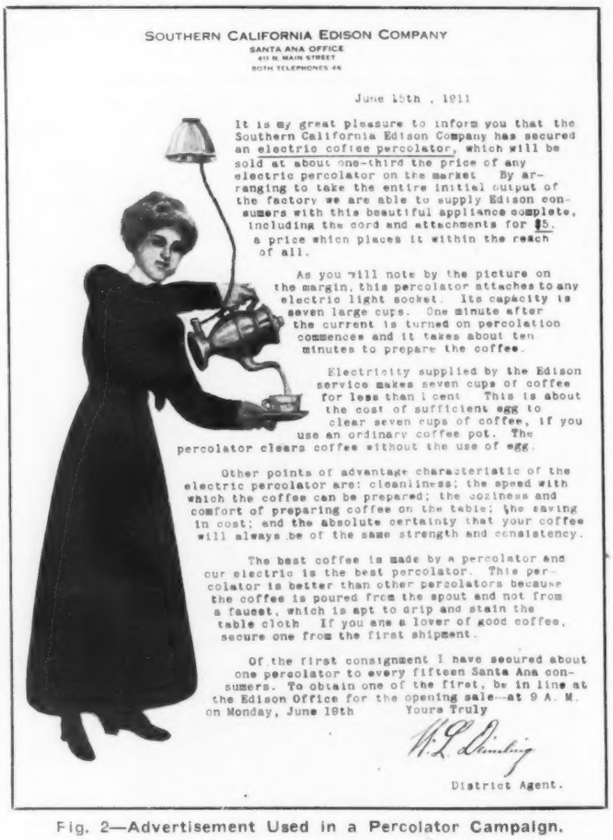
The company desired to load its lines in residence districts without adding any additional expenditure on investment account. The services, transformers and meters used on lighting circuits could be utilized for supplying energy for heating purposes. The company was not anxious to encourage the use of ranges, large air and water heaters, etc., which took a very considerable amount of energy when operating, until these appliances were well past the experimental stage. The main object was to get large quantities of efficient, energy-consuming, regularly used appliances on the lines, and to do it as rapidly as possible, in order to obtain the additional income derived from the energy consumed in the uses of such appliances.

ATTITUDE OF DEALERS.

The Southern California Edison Company found that if large quantities of desirable electrical appliances were to be distributed quickly among its customers, the company itself would have to do the work. It was true there were many dealers doing business in the cities and towns where the company supplied the electrical service. It was true they all had a few appliances on exhibition and all said they were in the business. But in most cases sales were made when customers went into their stores and asked concerning some appliance which they had heard about. The Edison company had water going to waste during the daylight hours; it had big steam turbines standing idle, waiting for a day load; it could not afford to await the time when the dealers would make up. A large and satisfactory load was ready to be taken on, only wanting an invitation.

METHODS ADOPTED.

At that time it was thought that if the company had showrooms in its various offices there would be many more sales of appliances. It was also believed that liberal advertising would rapidly increase the demand for useful devices. These methods were freely tried, but still the sales were relatively slow and not in the quantities desired. Many customers never went into an office of the company, many never read the advertisements in the papers nor the folders sent by mail. But the customers needed the appliances, although they did not all know it, and the company needed their business and knew it. There was only one thing to do, namely, to send good salesmen and demonstrators into the homes and let them tell the story and make the sales.



SOUTHERN CALIFORNIA EDISON COMPANY

SANTA ANA OFFICE
411 N. MAIN STREET
BOTH TELEPHONES 46

June 15th , 1911

It is my great pleasure to inform you that the Southern California Edison Company has secured an electric coffee percolator, which will be sold at about one-third the price of any electric percolator on the market By arranging to take the entire initial output of the factory we are able to supply Edison consumers with this beautiful appliance complete, including the cord and attachments for $5. a price which places it within the reach of all.

As you will note by the picture on the margin, this percolator attaches to any electric light socket. Its capacity is seven large cups. One minute after the current is turned on percolation commences and it takes about ten minutes to prepare the coffee.

Electricity supplied by the Edison service makes seven cups of coffee for less than 1 cent. This is about the cost of sufficient egg to clear seven cups of coffee, if you use an ordinary coffee pot. The percolator clears coffee without the use of egg.

Other points of advantage characteristic of the electric percolator are: cleanliness; the speed with which the coffee can be prepared; the coziness and comfort of preparing coffee on the table; the saving in cost; and the absolute certainty that your coffee will always be of the same strength and consistency.

The best coffee is made by a percolator and our electric is the best percolator. This percolator is better than other percolators because the coffee is poured from the spout and not from a faucet, which is apt to drip and stain the table cloth If you are a lover of good coffee, secure one from the first shipment.

Of the first consignment I have secured about one percolator to every fifteen Santa Ana consumers. To obtain one of the first, be in line at the Edison Office for the opening sale—at 9 A. M. on Monday, June 19th Yours Truly

W. L. Dimling

District Agent.

Fig. 2—Advertisement Used in a Percolator Campaign.

Three years ago the Edison company organized an

appliance-selling department for field work. There is at its head a chief appliance salesman, and he engages and superintends the work of his own assistants. He keeps from twelve to fifteen men going constantly, not spasmodically. These salesmen are paid a small salary and a large commission. They are satisfied with their incomes, and those in charge are satisfied with the results obtained. The company operates in some thirty cities, large and small, with an important rural business in intervening territory. A regular house-to-house canvass is maintained, and card records (Fig. 1) are kept showing what electric appliances are in use in each dwelling. The records, of course, show what appliances are not in use and what may yet be installed in each residence. As efficient appliances for new uses are coming out every few months, there seems to be no limit to the possibilities for sales to householders.

ADVERTISING.

The work of the appliance salesmen has been much assisted by proper advertising, the kind that pictures the use of the article, creates an interest in it and paves the way for the salesman when he makes his appearance. The flatiron is the greatest seller of all the appliances, but the sales

$5 OUR ELECTRIC TABLE-RANGE $5
IT FRIES, BOILS, GRILLS, BROILS AND BAKES.
WE WILL START THE SALE AT $5.00 PER RANGE, WITH ALL ATTACHMENTS.
TO AVOID DELAYS WE HAVE PLACED A VERY LARGE ORDER WITH THE FACTORY.
YOU CAN PREPARE A DAINTY MEAL WITH THE TABLE-RANGE. THE COST? LESS THAN ONE CENT FOR THE ELECTRICITY USED!
Southern California Edison Co.

Fig. 3—Poster Advertising a Table Range.

of other devices for regular use are now reaching considerable proportions. Each year the Edison company brings to the attention of its consumers at least one new appliance of unusual interest. The method of starting the sale is a communication to each consumer by mail. In 1911 the coffee percolator was put out at a popular price, and the accompanying advertisement (Fig. 2) printed in colors produced splendid results. In June, 1912, the table range was advertised as illustrated in the accompanying reprint (Fig. 3), but printed in colors. The sales of this new appliance for the short time elapsed have been heretofore unequaled by the sales of any other electrical appliance handled by the company for a similar period. This is accounted for not only because of the superior character of the advertising, but also because the company's customers are now more easily interested in electrical devices than formerly and will buy more readily any appliance which the company pronounces good and efficient.

RESULTS IN SALES.

As has been stated, the efforts of the appliance salesmen are directed toward selling such devices as use a reasonable amount of energy. There is no intention on the part of the company to underestimate the value of such devices as have small consumption, such as curling-iron heaters, cigar lighters and numerous other devices. However, just as much of the salesman's time is used selling a curling iron as a percolator or a toaster, and the latter is the most useful to the consumer and the most valuable to the company when in use. Consequently it is evident that the method adopted is the one which will bring the most satisfactory results.

Table I shows the quantities of appliances sold by the Southern California Edison Company to its own consumers during the year 1911.

TABLE I.—ELECTRICAL APPLIANCES SOLD IN 1911.

Irons	15,458	Air heaters	463
Toasters	3,440	Cooking	670
Percolators	4,634	Miscellaneous	816
		Total	25,481

The percolator sales above mentioned covered a period of seven months only. For the last seven months in 1911 and the first five months in 1912 the percolator sales amounted to over 6000. The miscellaneous sales cover appliances using approximately 3 amp and up and include small water heaters, kettles, vacuum cleaners, washing machines and other apparatus of similar character.

The total sales of electrical appliances of the classes herein referred to made by the Edison company to its consumers in the year 1910 were 14,135. In 1912 it is expected the total will again exceed 25,000 appliances. In 1910 the percentage of flatirons to the total sales was seventy-nine, and in 1911 the percentage of flatirons to the total sales was sixty-one. In the year 1912 it is expected that the percentage of flatirons to the total sales will be close to fifty. This does not indicate a decrease in the sale of irons but rather a satisfactory increase in the sales of other useful energy-consuming devices.

When the Southern California Edison Company first began selling electrical appliances in quantities it was considered advisable to sell most of the articles very nearly at cost price. The use of electricity for other purposes than lighting was new to the majority of people, and in arousing interest the price was an important factor in many cases. This condition gradually changed and the selling became more a question of salesmanship than one of price. In order to pay the expense of selling and handling, the prices of the leading appliances were slightly increased, but the sales continued to increase also. The company employed better salesmen, and the customers were more readily interested than previously.

At the present time all electric appliances with two or three exceptions are sold at the regular retail prices. During the year 1912 the company sold to its customers electric appliances for home use to a total gross value of approximately $120,000. The net profits on the sales were sufficient to cover all expenses in connection with the selling, delivering and handling of the year's output. These expenses included salaries and commissions to salesmen, clerks, storekeepers and drivers, the upkeep of delivery vehicles, advertising and postage and such expenses as belonged peculiarly to the appliance-selling department. In addition there was a satisfactory balance on the right side of the ledger account. It will thus be seen that the large output for the year of energy-consuming devices did not entail any additional expense to the company, but that the department was self-sustaining. This was the condition aimed at.

INCOME FROM USE OF APPLIANCES.

It will be remembered that this article does not deal with the very small energy-consuming devices, of which there are many, nor does it take into consideration the larger appliances such as ranges, water heaters, air heaters and the like, which require separate circuits, separate meters and lower rates for service. It deals with appliances using from about 3 amp to 6 amp each, which may be connected on a lighting circuit in any room in a house, the energy used being supplied through lighting meters at lighting rates. Each kind of appliance has a separate value to the company, from the standpoint of consumption, depending upon the frequency or regularity of its use. The Southern

California Edison Company has made very conservative estimates regarding the relative values of the various appliances sold to its customers, and figures given in the accompanying table are considered within the mark.

TABLE II.—COMPARATIVE FIGURES ON VARIOUS APPLIANCES.

Article.	Average Consumption, Watts.	Average Monthly Use, Hours.	Average Annual Consumption, Kw-Hr.
Flatirons	500	13	83
Toasters	530	10	60
Coffee percolators	500	6	36
Grills and stoves	500	5	30
Air heaters	600	12	86
Miscellaneous	300	5	18

In some localities the above estimates of annual consumption will be considered low. However, the Edison company in its calculations has based its estimates on the minimum average rather than on the maximum average. By multiplying the average annual consumption of any class of appliance by the rate per kilowatt-hour, and then multiplying by the number of appliances sold, the additional annual income from the sale and use of appliances may be arrived at. Of course, an allowance should be made for a percentage of the appliances sold by the company being out of use or carried away to other cities. To offset this, however, consideration should be given to the number of appliances bought by consumers from local dealers or brought in from outside points.

Again, when estimating income, consideration should be given to the fact that with the smallest consumers during certain months of the year part of the consumption from the use of appliances goes to use up the monthly minimum. However, such consumption, while it does not swell the company's income, is pleasing to those consumers who dislike to pay for something they think they are not getting.

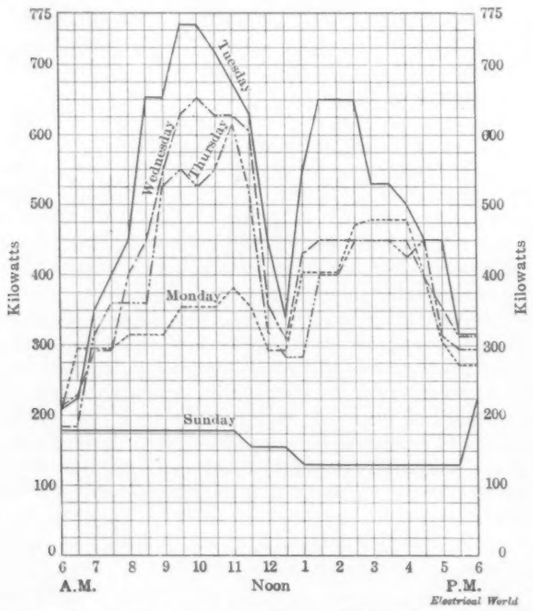


Fig. 4—Typical Day-Load Curves of Substation in Residential Section of Los Angeles.

EFFECT ON LOAD.

Electric appliances when sold in considerable quantities are bound to make a marked impression on the station load and a consequent improvement on the load-factor. Under some circumstances, where a day motor load is carried on circuits supplying residence service, it is difficult to demonstrate what part of the day load is from motor business and what part from heating, cooking or other uses for service to residences. However, the accompanying chart (Fig. 4) shows graphically what the use of electric irons can do in building up a load. The chart represents the typical day load carried on one of the Edison company's substations from which no industrial business is supplied. It shows curves representing Sunday, Monday, Tuesday, Wednesday and Thursday day loads. Friday and Saturday loads are not indicated in order to avoid crowding the chart too much, but the curves on these two days were very similar in shape to Thursday's. However, they indicated the gradual decreasing of the load toward the end of the week. It will be noted that a marked increase in the demand is apparent on Monday afternoon. The highest point is reached on Tuesday and the load continues high all day. Wednesday morning the load is also high, but there is a decrease in the afternoon. These load curves indicate the weekly use of electric irons under varying domestic arrangements.

Some of the strongest evidences of the actual use of electric appliances on the residence circuits are to be found in the troubles which are reported when the service on any of such circuits is interrupted. There was a time, not long ago, when a line in the residence district could be killed without causing any particular complaint during the daylight hours. It is different now. Recently it was necessary to make some repairs on one of the circuits in a portion of Los Angeles containing practically only dwellings and apartment houses. The foreman decided to do the work on a Sunday morning, when in his opinion the interruption to the service would be the least noticed. Accordingly, the supply was cut off about 8 a. m., and shortly afterward the company's trouble department was kept busy explaining over the telephone the reason for the interruption.

The Southern California Edison Company has over 80,000 customers and approximately 90,000 electric appliances on its lines of the kinds and capacities herein described. It is very evident that at all hours a large number of these appliances must be in use, and it may be the time is approaching when in some parts of the company's system duplicate circuits will be installed in order to avoid interruptions to service and the consequent inconvenience to consumers.

In southern California experience shows that each 1000 electric irons in use is equivalent to a load of 33 hp operating constantly for ten hours daily every working day of the year. A further calculation indicates that approximately 1500 of the other kinds of appliances referred to in this article would produce a load similar to 1000 irons. The energy supplied for this kind of a load is measured through lighting meters and is billed at lighting rates, and there need rarely be any extra investment in lines and transformers to handle the additional business represented by the use of even large numbers of appliances.

The aggressive work carried on in the selling of appliances in southern California has stimulated the business to a marvelous extent. Every pleased consumer using one or more of these devices becomes unconsciously an ardent advertiser, as the novelty of doing some kinds of housework by means of electricity and the satisfaction resulting therefrom is told by neighbor to neighbor and passed on from house to house. The Edison company is working in harmony with the majority of local dealers, and it is probable that the dealers as a whole are selling a greater volume of electrical appliances per capita in southern California than in any other territory in the United States. This condition exists, not in spite of the large volume of appliance sales made by the Edison company, but probably to a great extent because of the general stimulation to the business brought about by the policy of the company in its appliance department.

CHRISTMAS SALES OF ELECTRICAL APPLIANCES.

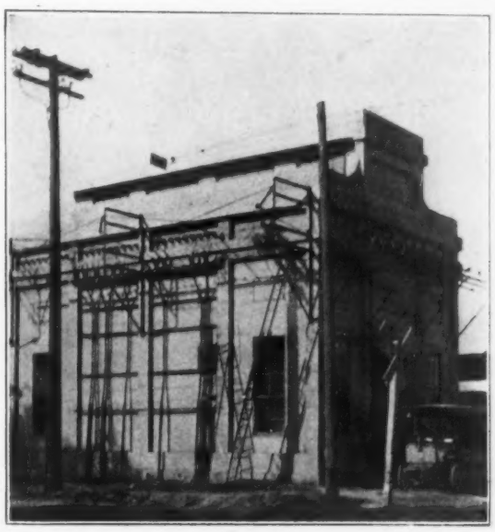
All over the country dealers in electrical supplies and electric-service companies are preparing for, or have actually begun, Christmas sales of electrical appliances, particularly such as are used in the household. Electric flatirons, toasters, portable lamps, coffee percolators, grills, small stoves and disks, heating pads, washing machines, vacuum cleaners, curling irons and the like make acceptable Christmas gifts. To a constantly increasing extent a special "drive" on them is made during the holiday season. The Byllesby properties, for instance, report that in their salesrooms perhaps 90 per cent of the sales of some of the more luxurious devices, such as electric chafing dishes, are confined to the holiday season. Manufacturers are now making special efforts to bring out attractive electrical novelties about this time of the year, and this is especially true in the case of electric toys, which are now available in a bewildering variety and at a wide range of prices. One very sensible result of this movement is the substitution to a considerable extent of electric Christmas-tree lighting outfits for the familiar Christmas-tree candle, which has been the cause of so many fires.

REINFORCED-CONCRETE SUBSTATION AT SACRAMENTO, CAL.

By R. B. MATEER.

Reinforced-concrete construction is characteristic of all buildings erected by the Great Western Power Company, one of the large generating concerns which formerly wholesaled all their output but which now are completing elaborate distribution systems in the five counties north of San Francisco, Cal.

Typical of the standardization policy of the power company is the substation recently completed at Eighth and "R" Streets, in Sacramento. The substation of reinforced concrete covers a space 30 ft. by 42 ft. and consists of a main floor and a mezzanine floor. On the lower floor are



Reinforced-Concrete Substation.

installed two banks of transformers, each consisting of three 750-kw water-cooled units.

Each bank of three transformers is connected in delta, receiving current at a potential of 24,000 volts. The secondary circuits are 2400 volts, three-phase, from which single-phase feeders for distribution purposes are run. The 24,000-volt service is brought from a substation where transformation from 102,000 volts to 24,000 volts is readily accomplished. Two separate feeders are brought to the Eighth and "R" Street substation, and after entering the building a simple system of switching is provided, permitting of either or both banks operating on any particular feeder and thus preventing a complete shut-down by reason of feeder trouble.

Relay switches and feeder regulators are installed on the mezzanine floor and provide for a regulation of 1 volt either way on each single-phase feeder. On the same floor are located the switches on the 24,000-volt line, also the distribution panels and meters.

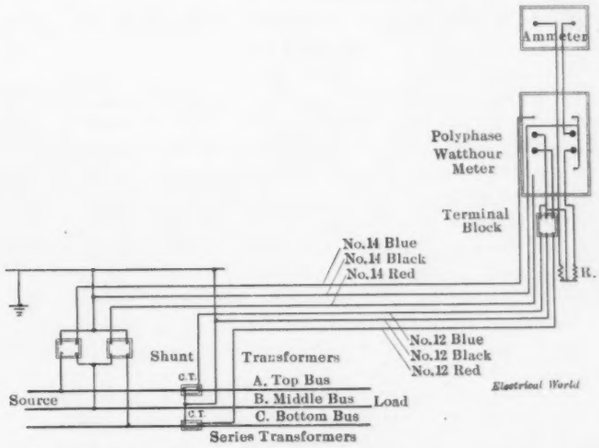
As some direct current is desired by certain consumers in the underground commercial section for the operation of elevators, a 300-kw direct-connected synchronous motor-generator set, consisting of a 450-hp motor and a 300-kw interpole, 275 and 550-volt generator, is operating continuously, except when the load is light, when it is carried by a smaller set consisting of a 150-hp, 2080-volt General Electric motor belted to a 100-kw multipole generator.

Wherever substations are desired structures similar to the one shown, though varying in equipment according to the load, are installed throughout the large area covered by the Great Western Power Company.

Wiring and Illumination

COLORED WIRE FOR SWITCHBOARDS AND PANELS.

Colored-braid wire is now standard for switchboard-instrument connections in the stations of the Kansas City Electric Light Company and for meter circuits in its customers' installations. Red, blue, brown and yellow are used to indicate various phases, etc., No. 12 being specified for series-transformer connections and No. 14 for voltmeter connections. The same color of wire is in each case associated with the same phase for both series and shunt connections, so that when connecting up a polyphase meter it is a simple matter to bring similar colors to similar phase binding posts. On any given switchboard or customer's panel the nomenclature is identical throughout. The same

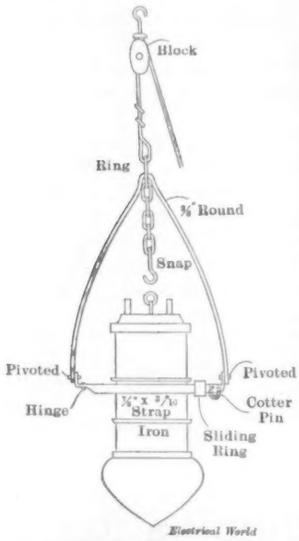


Use of Colored Wire for Instrument Connections.

rule does not hold between different installations, but the order of phase rotation, which is of chief importance, is always the same for all boards on the system. Black is used for the common return unless there is a third wire, in which case this phase receives a yellow wire. Manufacturers furnish this colored wire at a cost about 10 per cent in advance of regular wire prices.

CRADLE CLAMP FOR HANGING ARC LAMPS.

The candle used for hanging arc lamps which is shown in the accompanying sketch has proved of great value in installing the new 10-amp flame lamps at Omaha, Neb. These lamps, as is generally known, contain an annular row of loose chemical blocks inside the casing and above the globe. The blocks are laid insecurely in place, and if the lamp is tilted much while being hoisted into place, one or more blocks may become dislodged and fall into the globe, necessitating lowering, adjusting and hoisting the lamp all over again. If the lamp be lifted by an ordinary rope loop, it cannot, of course, be hoisted vertically, and even if hoisted by the hanger ring it will invariably be tilted while being pushed over and transferred to the permanent suspension hook.



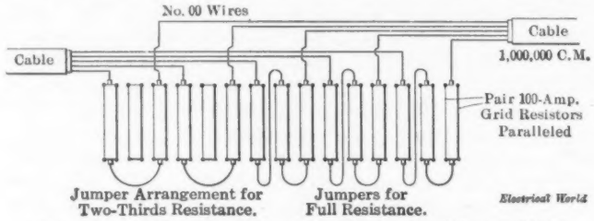
Cradle Clamp for Hanging Arc Lamps.

The rig illustrated was devised by Mr. F. Dickinson, who had charge of placing the Omaha lamps, and consists of a strap-iron ring hinged so as to open, but held shut to clamp the lamp case by a slip-ring with a protective collar pin. The suspension bale is pivoted to the hanger, as labeled in the illustration. The snap in the center is of help when first placing the lamp in the cradle. The lamp can be hung on the hook, which holds it free of the man's hands while the clamp ring is being closed and made fast. The whole rig is then hoisted to the proper height, turned 90 deg. from the plane of the paper as shown, and while held vertically with care, its weight supported by the cradle, is pushed over under its permanent hanger and connected. Use of this pivoted device has enabled the work of hanging the lamps to proceed much faster and has saved time lost in lowering and replacing lamps.

INTERCHANGEABLE CONNECTIONS FOR FEEDER RESISTANCE.

In order to get the same pressure on direct-current mains near the station as in outlying sections supplied over comparatively long feeder lines, some engineers have actually gone to the point of carrying a 1,000,000-circ. mil cable half the length of one of the longer feeders and then back again to the mains near the station, in this way obtaining the desired drop in voltage. A scheme of making the feeder resistance adjustable inside the station itself is employed by the Kansas City Electric Light Company, which has made good use of some standard railway grid resistors in equipping a short heavily loaded feeder that terminates within 75 ft. of the station bus.

Securing the largest railway grid resistors to be had and neglecting their intermittent rating for car use, special tests made showed that these grids would carry 100 amp continuously. Pairs of these grids were then permanently paralleled, and groups of fifteen such pairs mounted in racks, one thirty-grid group being provided for the positive side and a similar group for the negative, as the sketch shows. By means of the jumper wires and lugs used with the diverter grids on the cars any adjustment from full to two-thirds of full resistance can be obtained. The arrangement of jumpers for these two conditions is illustrated.. At full load the 75-ft. 1,000,000-circ. mil feeder thus equipped carries 1000 amp, and the drop across the resistance banks is about 10 volts. With all resistance in, the resistance of the grids about equals the resistance of 1000 ft. of 1,000,000-circ. mil copper cable, so that the terminal pressure on this short line is about equal to that on the other full-length feeders, the shortest of which is 1000 ft. The resistor grids



Interchangeable Connections for Feeder Resistance Grids.

are mounted in the basement of the Fifteenth Street direct-current substation without any special provision for carrying off the heat developed.

A ST. LOUIS THEATER FRONT WITH 9000 TUNGSTEN LAMPS.

Nine thousand tungsten lamps, ranging in size from 5 watts to 25 watts, are employed to light the 100-ft. three-story front of Talbot's Hippodrome, St. Louis, probably the most elaborately illuminated building in the country. Altogether in stage, auditorium and decorative lighting the Hippodrome equipment comprises 18,000 lamps, and 8000 others are used in roof signs throughout the city to adver-

Lighting of St. Louis Hippodrome.

tise the performances. The house has a seating capacity of 3000 and is run as a 10-cent vaudeville theater with continuous shows from 11 a. m. to 11 p. m.

Of the 9000 lamps on the front, 1100 in the canopy are 25-watt, 110-volt units. The remainder are 5-watt, 12-volt lamps, supplied through an inverted rotary converter and transformers from the 220-volt direct-current system of

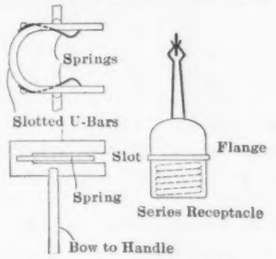
the Union Electric Light & Power Company. The 25-kw rotary delivers two-phase alternating current to two 12-kw transformers whose rated secondary output is 1000 amp at 12 volts. A flasher, one of the largest ever built, heightens the effect of the display lighting by switching on the lamps with various chaser effects. The central cornice first appears, the light running from lamp to lamp. Then in succession the center windows light up, and the glow thus spreads over the whole face of the building. The display recurs on a one-minute cycle, seventeen seconds being occupied in "building up" and three seconds in extinguishing all the decorative lamps. The Reynolds flasher which performs this result contains twenty rolls and 380 contact fingers, controls eighty-four circuits and is 7 ft. long, 6 ft. high and 30 in. deep. A ⅛-hp motor drives it. The flasher is mounted in a glass case behind the balcony, in full view of the second-story audience. All flashing of the 12-volt lamps is done on the secondary or low-voltage side, without objectionable sparking or heating of current-carrying parts, although, of course, a total of 2000 amp at 12 volts is interrupted when the circuits are broken.

Fig. 1—Buffalo General Electric Company's Building by Day.

To advertise the Hippodrome ten roof signs are installed in prominent positions throughout the city. Each sign contains from 600 to 800 lamps, and each has a flasher device with kaleidoscope effect.

HOLDER FOR REMOVING STREET-SERIES RECEPTACLES.

For removing and replacing street series receptacles the line department of the Omaha Electric Light & Power Company finds that the home-made U-bar device illustrated has many advantages over the usual pull-rope extractor. The holder is formed of two U-bars with a slot between them wide enough to span the flange on the porcelain receptacle. Working in the slot are a pair of light springs which grip the socket just firmly enough to prevent it from falling out of the holder while being lowered. The slot itself holds the flange firmly against any vertical movement. A long wooden handle is attached to the holder through a spreader bow which clears the lamp.



Holder for Removing Street Series Receptacles.
Electrical World

ILLUMINATION OF BUFFALO GENERAL ELECTRIC COMPANY'S OFFICE BUILDING.

The new office building of the Buffalo (N. Y.) General Electric Company, located at the intersection of Genesee, Washington and Huron Streets, is a distinct landmark of Buffalo, its light being visible at night for a distance of about 15 miles out on Lake Erie and the structure itself being the highest in the city. The Electric Building, as it is called, is 300 ft. high and consists of a main structure of four stories surmounted by a monumental tower as shown in Fig. 1. Being faced with white glazed terra cotta, the building is distinctive both by day and by night, and much thought has been expended in making its appearance by night especially attractive. The illumination of the structure both within and without was intrusted to Mr. W. D'A. Ryan, of the General Electric Company, and the building is said to be the best lighted edifice of its kind in the world. Certainly the illustrations shown herewith, which are reproduced from undoctored photographs taken at night under artificial light without the aid of flash-lights, would seem to bear out this contention.

Fig. 2—Buffalo General Electric Building at Night.

The basement and first and second floors of the building are occupied by the Buffalo General Electric Company; the third floor is occupied by the Cataract Power & Conduit Company, and the fourteenth floor is used as an assembly room for employees of the company. The other floors are rented for office purposes.

The exterior of the building is illuminated by magnetite-arc lamps. In the square in front of the structure is a special post holding five 6.6-amp series ornamental luminous-arc lamps, and along the curb of the streets on which the building faces are lamps of the same type and rating. On the top of the main structure and also on the cappings at the tower steps on the fourteenth, fifteenth and sixteenth floors 6.6-amp magnetite-arc lamps are also mounted on standards, while topping the whole are three 30-in. projectors mounted on a revolving platform. The latter are also provided with motors so that they revolve on their own centers through color evolutions produced by screens mounted on projectors.

Semi-indirect units are employed for the general interior illumination, the fixtures being designed for the building. The illumination ranges between 4 ft.-candles and 6 ft.-candles and the power consumption averages about 1.4 watts per sq. ft. Either direct or semi-indirect lighting is possible in the offices, the main units there installed being of the

convertible type. The thirteenth, fourteenth and fifteenth floors are fitted with special fixtures equipped with 500-watt and 250-watt lamps, so that a strong light is thrown through the heavily latticed windows while the room itself receives abundant semi-indirect illumination. Fig. 2 shows a view

Fig. 3—Rotunda Illuminated by Semi-Indirect Tungsten Fixtures.

of the building at night. Tungsten lamps are used exclusively throughout the interior of the building and their arrangement, as well as data on the fixtures employed throughout the structure, was outlined by the illuminating engineer in charge of the work in a paper before the Illuminating Engineering Society at its convention in Niagara Falls, Ont., Sept. 16-19, 1912. The structure as a whole is an

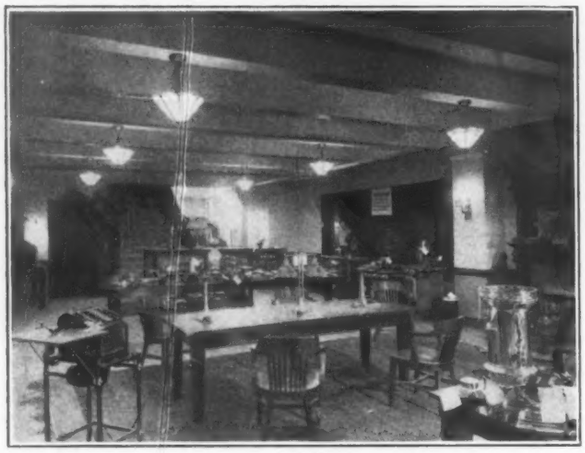


Fig. 4—Exhibition Room.

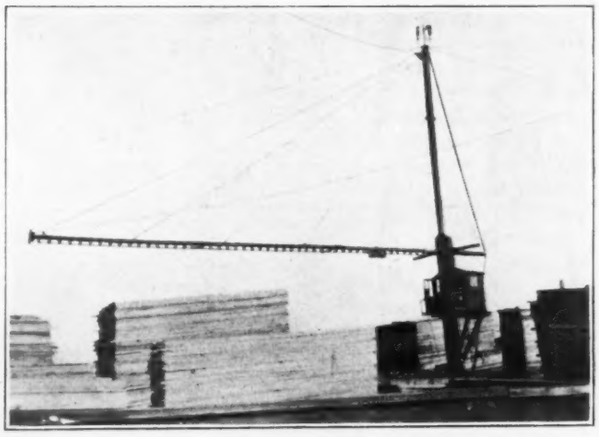
ornament to the city of Buffalo and, like that of the Denver Gas & Electric Light Company, of Denver, Col., serves to emphasize the fact that the lighting company is one of the great concerns of the city while at the same time dignifying the use of electricity for advertising purposes.

HOUSE-TOP DISTRIBUTION CONSTRUCTION IN A MINERS' VILLAGE.

In bringing electric service into a miners' village of fifty-six shacks, all alike and grouped close together, it was necessary for the local central station to devise some means of distribution that would be inexpensive and miss the narrow spaces between houses. It was accordingly decided to mount insulators on the ridge-poles of the various houses, stringing the wires from top to top without other pole support. From these main-line wires drops were carried directly down into the houses. Installing four drop cords in each house, two men were able to complete an entire wiring job in twenty-five minutes at a total cost of about $6 per house. Even rosettes were dispensed with, the lamp cords being soldered directly onto the house wires. The miners have proved to be good customers at regular meter rates, their bills averaging from $1 to $2 every month.

FLAME-ARC LAMPS FOR LUMBER-YARD LIGHTING.

For handling lumber after dark in the yard of the Thornton & Claney Company, 2315 Elston Avenue, Chicago, the masts of the derricks are equipped with flame-arc lamps. Each of the three 75-ft. derrick masts carries four long-hour flaming units, affording good working illumination in the yard below, within the radius of the 75-ft. horizontal booms. On these booms trolleys carrying the hoisting grab-hooks travel back and forth, hoist, travel and rotation



Motor-Driven Lumber Crane Equipped with Flame-Arc Lamps.

motions being all performed by motor drive. As the entire mast structure must rotate freely in any direction, the lamps are hung from a frame mounted on the stationary swivel ring to which the eight steel-rope guy lines are attached. The wires supplying energy to the lamps are carried as a cable on marlin hangers using one of the guys as a messenger wire. A ladder on the main upright gives access to the lamps for trimming.

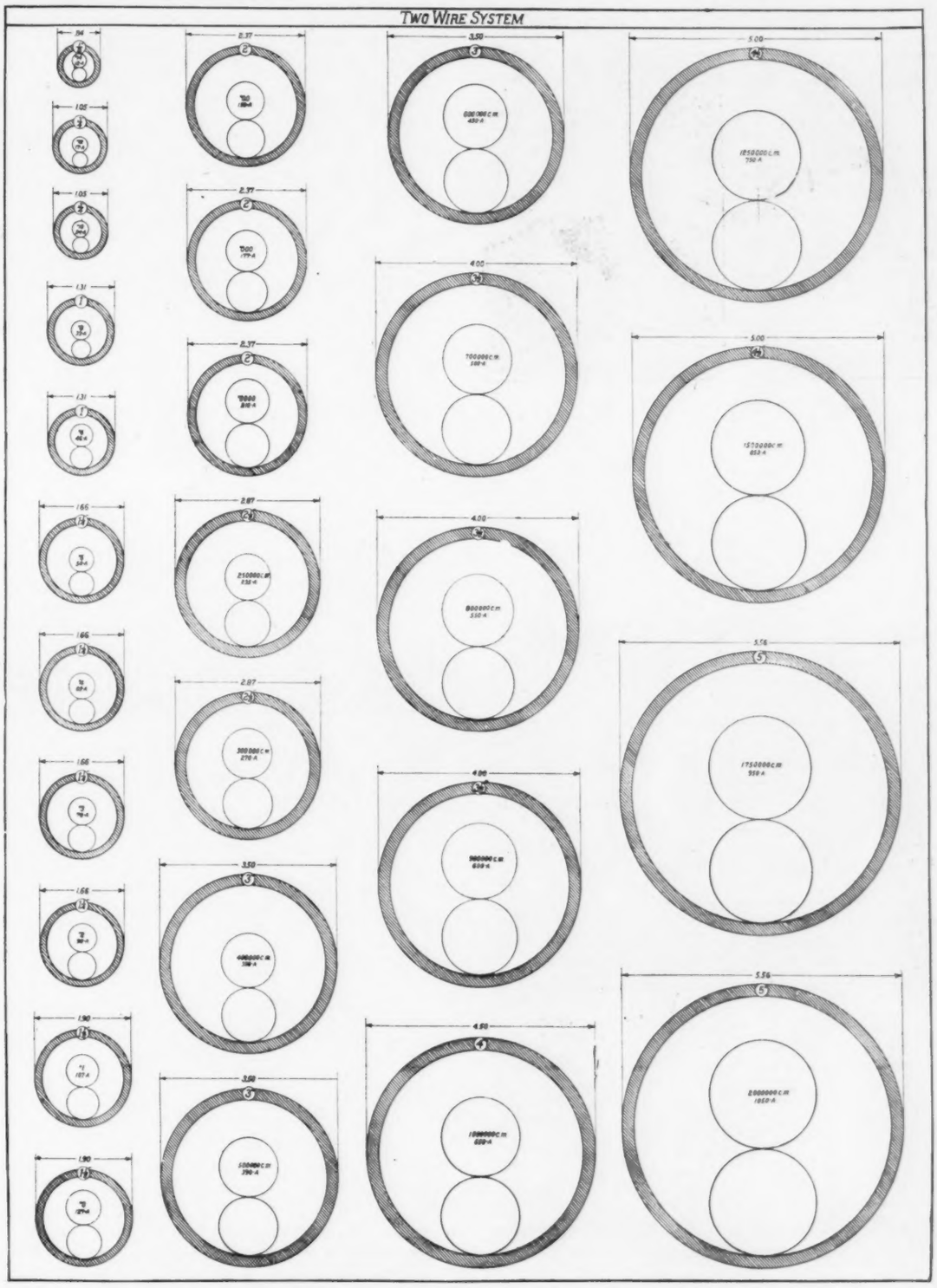
STANDARD SIZES OF CONDUIT FOR INSTALLATION OF WIRES AND CABLES.

The National Electrical Contractors' Association has recognized the necessity and the desirability of accurate data to be used in selecting the proper sizes of conduit for installations of wires and cables. In the interest of establishing a national standard which may be referred to in writing conduit specifications, the above association, after making a careful study of the actual conditions encountered in making installations, has prepared and officially adopted a group of six charts, on which this information is shown in an elaborate set of drawings.

The charts show the conduits and conductors full size and also give the outside diameter of the conduit and the carrying capacity of the wire, so that the actual working conditions are placed before the designer in a form which is very convenient to use. The charts are so made up that they show the proper sizes of conduit to be used with one, two, three, four and convertible three-wire systems and combinations of duplex wires in sizes Nos. 10, 12 and 14;

single-wire combinations of No. 14 wire up to ninety wires; combinations of No. 16 and No. 18 fixture wire up to 150 wires, and combinations of telephone wire up to fifty pairs. It is claimed that this will cover practically all of the data necessary for any installation. In the past there has been a tendency to use conduits of too small interior diameter, and in the preparation of these charts care has been taken to recommend conduits of sufficient size to meet all working conditions and at the same time to keep in mind that economy in installations should be considered and extravagant sizes of conduit not recommended. These charts are mounted on heavy pressboard and are fitted with an eyelet at the top to facilitate hanging.

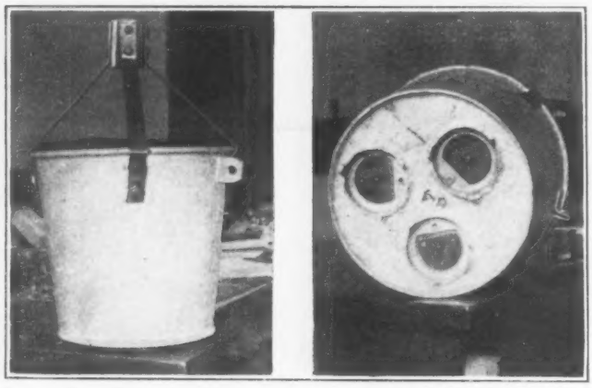
The work and expense of preparation of these charts has been borne by the National Electrical Contractors' Association, and in order that they may soon become universal among the electrical contractors of the country the association is prepared to furnish them at cost. The illustration herewith shows a portion of one of the charts reduced. Mr. W. H. Morton, No. 41 Martin Building, Utica, N. Y., is the secretary of the National Electrical Contractors' Association.



Standard Size of Conduits Recommended by the National Electric Contractors' Association.

BUCKET FOR BAILING POLE HOLES.

Recently it became necessary to run a pole line through territory which was rather swampy, entailing considerable difficulty in keeping water out of the holes while they were being dug. It was found impracticable to use the ordinary hand pump, because the amount of water necessary to



Bucket for Bailing Out Pole Hole.

prime the pump was almost as much as the water in the hole, and it took a great deal of time to pump out.

Mr. Schuster, of the Cosmopolitan Power Company, Chicago, in charge of the work, devised a little scheme which seems new. As shown by the accompanying photographs, a heavy galvanized pail was taken and three flat valves from an ordinary hand pump were soldered in the bottom of the pail. All that is necessary to pump the water out of the hole is to push the pail down into the hole, which opens the valves, allowing the water to run in. The withdrawing of the pail closes the valves and the water can be emptied out.

ORNAMENTAL LIGHTING FROM TROLLEY POLES.

Where combination lighting arms can be used with the tubular poles supporting trolley span wires a dignified and handsome system of ornamental illumination is obtained at reduced cost for fixtures and without introducing addi-

Trolley-Post Street-Lighting Standards.

tional structures along the street. Seven blocks in the business section of Emporia, Kan., are lighted by 50-watt series tungsten lamps installed in this way, two to a pole, on poles 70 ft. apart, or ten to the block. As the street is 100 ft. wide, or 70 ft. between curbs, the posts are at the corners of 70-ft. squares. The wiring is arranged in two circuits, permitting diagonal lamps at crossings to burn all night, while the remaining units are extinguished at 11 o'clock. Lead-covered 2500-volt cable is used for the 4-amp series circuits, but this cable has developed mysterious grounds where the lead was in contact with the iron in the arms. Bad pitting resulted from electrolytic action, so that the lead had to be removed and the cable taped and covered with insulating compound instead. Despite trolley-wire vibrations, the lamps have shown excellent life performances.

The city pays for the outside lamps overhanging the street, while the local merchants are assessed by the company on a front-foot basis for the lamps on the sidewalk side. The schedule earned is $15 a year or $1.25 monthly for operating each 50-watt lamp, including maintenance and renewals, the company furnishing poles, arms, etc. As elsewhere, this plan, by which the company is required to dun merchants for street lighting (the highest bill reaching scarcely $1.75), has hardly proved a satisfactory arrangement, as it causes additional collection expense and is a source of possible dissension. If desired later, additional arms can be installed on the present posts, making four-lamp standards.

Letter to the Editors

ELECTRIC-HEATING DEVICES.

To the Editors of the Electrical World:

Sirs:—For the past fifteen or sixteen years the firm Shepherd & Burt, with which the writer is associated, has been handling electric-heating devices. During the earlier years of this period it was almost impossible to arouse more than a mild interest in them. However, during the last few years there has been a great awakening and an increased interest is being manifested. This result is attributable largely to the growing use of electricity in general, but more especially to the direct appeals in an advertising way that are being sent out by nearly all manufacturing companies. Experience shows that possibly the greatest single point involved in the use or otherwise of this apparatus hinges on the question of the rate for energy. There is no doubt, for example, that a rate of 5 cents or less would more than double the demand for this apparatus in this territory. It is believed that this same condition would obtain in most other places also. It would seem, therefore, to be simply a case of the central station determining whether the largely increased consumption at the lower rate would offset the loss in revenue due to the lower price per kilowatt-hour. The answer to this question to-day among aggressive central stations is believed to be in the affirmative.

In addition to the fact that there is undoubtedly a large and profitable revenue in this business at the lower rate indicated, the potential benefits which invariably follow by reason of the increased popularity of electric service go a long way toward making up any actual loss, due to the reduced rate. The writer believes that it more than wipes out this reduction, and in addition actually effects an increase in revenue. In the coal regions, where fuel is the cheapest on earth, almost without exception the lighting companies are asking 10 cents per kw-hr. for all energy other than that required for motors. This, of course, means a 10-cent rate for energy-consuming devices.

The time is no doubt near, if not actually at hand, when these companies will experience a full realization of the enormous possibilities at hand in the energy-consuming-device field. Understanding this, they will offer special rates for this service commensurate with the volume of business thus produced. There is no doubt whatever that this idea will shortly take hold among central stations throughout the country.

Wilkes-Barre, Pa. G. E. Shepherd.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Transformer Design.—M. VIDMAR.—A highly mathematical paper in which the author first describes the construction of a transformer with cooling ribs. The description of the construction is followed by formulas for calculating the dimensions so as to reduce to a minimum the losses, the price and the weight. The results obtained are illustrated by a practical example. From the formulas for a single transformer those for the whole series of a type may be derived, and the general laws for the price, linear dimensions, weight and losses are given for such a series.—*Elek. u. Masch.* (Vienna), Nov. 10 and 17, 1912.

Abnormal Strains in Transformers.—C. P. STEINMETZ.—The author analyzes the abnormal strains in transformers in a very simple manner, under the headings of over-voltage, over-current and over-frequency strains. Effective arresters, choke coils and heavy end-turn insulation take care of the first; heavy current conditions may be handled by a stout mechanical design and the provision of high reactances, internal and sometimes external; while in guarding the transformer against high-frequency strains resort may be made to a combination of inductances with energy-absorbing devices, the former to guard against excessive intensity of traveling waves, the latter against the formation of standing waves from whatever traveling waves may appear in the system.—*Gen. Elec. Review,* December, 1912.

Lamps and Lighting.

Large Turbo-Generators.—An article on three 30,000-hp, 21,500-kva steam turbo-generators, of which two have been erected in the Düsseldorf-Reisholz power plant of the Rhineland Westfalen Electricity Works, while the third machine is at present being installed in the Essen power plant. The two former were built, one by the Allgemeine Elektricitäts Gesellschaft and the other by Brown, Boveri & Company, while the third one was built by Escher, Wyss & Company and the Siemens-Schuckert company. The two former machines have now been in operation for several months and have proved perfectly satisfactory. The power plant at Düsseldorf-Reisholz now contains three turbo-dynamos, each of 7150 kva (installed in 1903), and the two new sets contain each 21,500 kva. The total rating is therefore 65,000 kva. The pumps for cooling water and air are driven partly by electric motors and partly by steam turbines. Each turbo-dynamo requires a pumping capacity of 280 kw and about 5000 cu. m of cooling water per hour for condensation. The excitation voltage is 220 volts, the three-phase generator emf 5250 volts.—*Elek. Zeit.,* Nov. 14, 1912.

State-Owned Water-Power Plant.—The second chamber of the Parliament of the State of Baden in Germany has adopted the bill on the erection of a power plant utilizing the Murg water-powers by the State and its operation by the State. The electrical energy will be sold at as low prices as possible, and if it is sold to large consumers who may sell again to smaller consumers, it will be stipulated that the selling price must be very low.—*Elek. Zeit.,* Nov. 14, 1912.

Electric Winding Engines.—A. E. DU PASQUIER.—A paper read before the South Wales Institute of Engineers and illustrated by diagrams. The author considers some of the more important principles underlying the selection and design of the most suitable type of winder for any particular conditions, with special reference to the influence of drum profile on the performance to be obtained.—London *Electrician,* Nov. 15, 1912.

Corona.—F. W. PEEK, JR.—An article on a further investigation into the nature of the corona and the dielectric strength of air by means of a short high-voltage line. The author shows how corona values calculated from the laws and formulas already established by the author check with values as actually noted on working lines by other investigators. He then touches on the practical importance of recent experiments with the stroboscope and the discovery of the difference between the corona on the positive and negative halves of the alternating-current wave. He deals with visual corona and gives a theory explaining the apparent greater dielectric strength of air around small conductors than around large. The author finally discusses the corona limit of high-voltage transmission.—*Gen. Elec. Review,* December, 1912.

Traction.

Autoconverter for Automobiles.—J. N. JACOBSEN.—An illustrated article on the use on automobiles of the "C. M. B. autoconverter," which has already been described in the *Digest.* In Fig. 1 the autoconverter is represented by *AB,* where *A* is the "motor part" and *B* the "generator

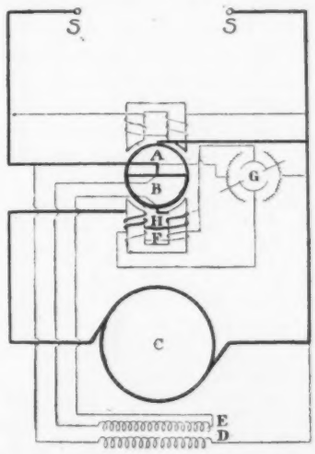


Fig. 1—Diagram of Connections.

part" of the autoconverter. According to the direction and strength of the exciting current, the voltage of *B* is either added to or subtracted from the supply voltage *SS,* so that the voltage impressed on the motor *C* can be varied between zero and twice the voltage *SS.* In an automobile *SS* is a storage battery, in a trolley car the line. *C* is the driving motor of the car. *G* is a rheostat which permits the exciting current for the excitation winding *F* of *B* to vary in strength and direction. There is a second excitation winding *H* provided for *B.* This is in series with the motor *C,* creating an mmf in opposition to that of *F* when *B* furnishes energy to C. The motor *C* has two excitation windings, of which one *D* is directly connected to the storage battery and the other *E* is fed from the autoconverter *B,* its mmf changing with the emf of *B.* It is opposed to the field created by *D* when the motor *C* is at normal speed, and, on the other hand, it strengthens this field when the motor is started or stopped. The control arrangements and equipment of the car are described in some detail.—*La Lumière Elec.,* Nov. 2, 1912.

Gasoline-Electric Automobiles.—A note on a recent British patent (No. 7992, Nov. 7, 1912) of Allmanna Svenska Elektriska Aktiebologet. To obtain the smallest possible machines and losses, the motor torque variations

should take place with a minimum change in the main pressure and current. This may be obtained by the driving motor having three field windings, one shunted across the generator, another in series with the armatures of the generator and motor, producing a field in the opposite sense to that of the shunt winding, and a third connected to the armature of the exciter.—London *Elec. Eng'ing*, Nov. 14, 1912.

Single-Phase Traction in Norway.—F. Marguerre.—The conclusion of his long illustrated article on single-phase traction at Rjukanfos. The 500-hp locomotives and their equipment are described and illustrated. The general results obtained on this line are summarized. Some of the early troubles experienced are noted.—*La Lumière Elec.*, Nov. 2, 1912.

Installations, Systems and Appliances.

Life of Plant.—A long editorial on the life of plant in electric central stations. The periods for the repayment of loans of municipal stations were fixed in 1906 by the London County Council as fifty years for buildings, thirty years for mains and twenty years for plant. Robert Hammond, in a paper read in 1907, estimated the life of buildings at sixty years, that of boilers at twenty, engines at twenty-five, turbines at twenty, armored mains at twenty-five and mains laid "solid" or in ducts at thirty years. In 1906 Sir William Preece gave the following figures: Buildings, eighty years; boilers, twenty-two to twenty-five; generators, thirty; engines, twenty-five; armored cables, thirty-five, and mains laid "solid," forty years. Data as to life of plant are given from actual practice of British central stations which have been in operation for twenty years or more. The figures given show that from twenty to twenty-five years is by no means a limiting period for the life of mains. In regard to generating plant, this may have a useful life of twenty years or perhaps more, but owing to expansion or to the introduction of more efficient types of plant the time during which it may pay to use any item of machinery may be considerably less than twenty years. In other words, obsolescence plays a part and may become an important factor. As far as life is considered (that is, the time during which the plant is capable of doing its work efficiently) there is no justification for the shortness of the periods now being allowed by the London County Council and the Local Government Board, provided, of course, the plant is properly maintained. But a substantial fund should be set aside for the replacement of plant should this be necessary before the expiration of the period of repayment of the loan.—London *Electrician*, Nov. 8, 1912.

Electric Installation at Stoneleigh Abbey.—An illustrated description of the electric light and power installation at Stoneleigh Abbey, Kenilworth, England. In addition to a very extensive lighting installation with metallic-filament lamps it provides for the electric driving of the farm and estate machinery. The system employed is two-wire direct current at 100 volts. The power plant contains two Diesel engines coupled to two 260-amp, 100/150-volt generators. A battery is provided with fifty-six cells, each of 2000 amp at ten-hour rating. It is capable of giving a discharge of 800 to 900 amp for short periods without injury and can supply power to a 40-hp motor in the sawmill, or to the fire pump, for several hours. For fire protection a very complete electrical pumping plant and system of hydrants has been installed, which insures the provision of an instant and abundant supply of water.—London *Elec. Review*, Nov. 1, 1912.

German Electrical Industry.—Statistical figures on the German stock companies building electrical machines, apparatus, etc., or selling electrical energy, with figures on capital invested, income, net earnings and net losses, dividends, etc. The general conclusion is that the electrical stock companies are less dependent on the fluctuations in the general industrial situation than are other industrial stock companies. For instance, the number of the industrial stock companies which show a net loss has increased more than that of those which show a net gain. The only exceptions are the electrical supply companies. Most of the companies paid last year dividends between 5 and 10 per cent.—*Elek. Zeit.*, Nov. 14, 1912.

Single-Phase Induction Regulators.—A note on a recent British patent (No. 7697, Nov. 7, 1912) of the Siemens-Schuckert company. To overcome the vibration, which is mainly due to the interaction of the pulsating magnetic field and the stator, auxiliary windings on the rotor and stator are traversed by currents differing in phase, owing to insertion of resistances, inductances and capacities, or to connection to the exciting or compensating windings of a motor controlled by the regulator. Alternatively two stators and two rotors (mechanically coupled so that their mean torques are opposed) may be employed.—London *Elec. Eng'ing*, Nov. 14, 1912.

Large-Capacity Switch.—An illustrated description of a 6000-amp to 7000-amp, 750-volt, three-phase hand-operated automatic oil switch made by a British company.—London *Electrician*, Nov. 15, 1912.

Wires, Wiring and Conduits.

Insulated Cables.—A note on a recent British patent (No. 21,334, Nov. 7, 1912) of F. H. Broomfield and E. H. Tawn. Impregnated paper or fibrous insulated cables often have a tendency to let the impregnating material flow to the lowest part of the cable. A method is described for overcoming this and for providing at the same time a non-hygroscopic insulation. The preferred constitution and approximate percentages by weight of the impregnating mixture are: Soft cottonseed pitch, 10; second-quality castor oil, 80; gilsonite asphaltum, 16; cottonseed oil, 2; heavy lubricating oil, 2; pure Venice turpentine, 8; carbon tetrachloride, 4; light petroleum distillate, 40.—London *Elec. Eng'ing*, Nov. 14, 1912.

Electrophysics and Magnetism.

Recoil Atoms in Ionized Air.—A. F. Kovarik.—When a radioactive emanation disintegrates, the atom of the newly formed substance may be drawn to a negatively charged electrode, and it seems that the recoil atoms of all disintegrating radioactive atoms behave like positive ions. The author investigated whether the recoil atoms could be collected on a negatively charged electrode when the air between the plates of the field was strongly ionized. His results show that the number of atoms drawn to the negative electrode through ionized air would diminish with the intensity of the ionization on account of the neutralization of the charge of the atoms with the negative ions of the air. An investigation was also made showing that the number of recoil atoms drawn to the negative electrode increased as the potential difference between the plates was increased, the distance remaining constant, and also that the number increased as the distance was decreased, the potential difference being constant.—*Philos. Magazine*, November, 1912.

Magnetic Properties of Manganese and Nickel Steels.—S. Hilpert and W. Mathesius.—In a paper read before the Iron and Steel Institute the authors give the results of an investigation in which the magnetic properties (intensity of magnetization and coercive force) of previously heat-treated steels were measured at ordinary temperatures. In all the steels the magnetizability after quenching from 1200 deg. C was greatly increased as compared with that of the same material after similar treatment at lower temperatures and also after slow cooling. By means of systematic thermal treatment in combination with magnetic measurements it has been shown that at high temperatures (above 1050 deg. C.) substances are formed which at ordinary temperatures are strongly magnetic but in spite of quenching cannot be obtained in a pure state. All the steels, with the exception of nickel steel with

31 per cent of nickel, showed both in the quenched and in the slowly cooled specimens an increase in the magnetizability when annealed at temperatures between 400 deg. C. and 450 deg. C. This is not, in any case, an aging phenomenon, but is the result of a new state which is obtained only by the heating process. In general, it has been shown that the circumstance whether or not the heat treatment has been carried out under a rising or a falling temperature has a decisive influence upon the magnetic properties.—London *Electrician*, Nov. 1, 1912.

Heusler Alloys.—P. W. GUMAER.—Heusler alloys are the peculiar manganese alloys composed of metals which ordinarily are non-magnetic. The object of the present author's investigation was to study the effect of temperature upon the saturation value of the intensity of magnetization; then to determine, if possible, from the data obtained, the structure of the molecular magnets. One result is that the temperature of magnetic transformation from the ferromagnetic to the paramagnetic state was established at 310 deg. C. for the alloys containing 62 per cent copper. The results, while not extensive enough to determine the number and kinds of atoms in the elementary magnet, are sufficient to show that the alloys obey the law of ferromagnetism, as derived by the present molecular theory.—*Physical Review*, October, 1912.

Electrochemistry and Batteries.

Electric Welding.—V. D. GREEN.—The first part of an illustrated article. Disadvantages of the arc process are that the results depend entirely on the skill of the operator, that it is not as safe as the resistance process, and that the difficulities of keeping the arc reasonably steady become more and more serious as the work to be done becomes smaller. The welding process of Elihu Thomson is described and the limitations of the electric welding process for rods and bars are given. Iron and steel should be as soft and pure as possible to be specially suitable for electric welding.—London *Electrical Review*, Nov. 15, 1912.

Burning of Lugs of Accumulator Plates.—Two illustrated descriptions are given of the procedure in lead burning for the purpose of lengthening the lugs of storage-battery plates.—London *Elec. Eng'ing*, Nov. 14, 1912.

Units, Measurements and Instruments.

German Reichsanstalt.—A review of a special report of the work of the Physico-Technical Reichsanstalt of Germany from 1907 to 1911. In general the scope of the work has remained the same. Of general investigations are mentioned experimental researches on the foundations of thermodynamics, saturated steam, specific heats, mechanical equivalent of heat, electric and thermal properties of metals and the international agreement on the emf of the Weston cell. The work in Department I included investigations on mechanics and heat, electricity and magnetism, standard resistances, standard cells, precision measurement of magnetic fluxes, formation of nitric oxide by the silent discharge, electronegative gases and radiation theory. The work in Department II included tests of electrical and magnetic machines, apparatus and appliances, sources of errors in electricity meters, alternating-current instruments, methods of determining the stray fluxes in transformers and induction motors, measurement of capacities and inductances, the absolute unit of electric resistance, measurements and wave-lengths in wireless telegraphy, electrochemical valves or rectifiers, tests of telephone and telegraph instruments and appliances. The magnetic work included the design and calibration of apparatus for testing magnetic materials, determination of initial permeability and measurement of high inductions. No less than 69,315 thermometers were tested and extensive work was carried out on fixing the temperature scale of the nitrogen thermometer up to 600 deg. C., and the hydrogen thermometer scale up to 190 deg. C. For high temperatures there was a steady, rapid increase in the number of electrical and optical pyrometers tested. In the optical department many photometric investigations were made. In the chemical department methods for producing pure metals were developed and the influence of small impurities was determined.—*Elek. Zeit.*, Nov. 14, 1912.

Substitution of Direct Current for Alternating Current in Cable Tests.—J. DELON.—A description of an apparatus which permits tests of long cables by means of a high direct-current voltage. The power consumption of the apparatus is small and the apparatus can be easily transported. As shown in Fig. 2, the metallic rod E is mounted on a hard-rubber disk revolving around an axle c. Four stationary brushes, b_1, b_2, b_3 and b_4, are arranged as shown. b_3 and b_4 are electrically connected together and with one terminal p of the high-voltage side of a transformer. The other two brushes b_1 and b_2 are connected to one plate each of the condensers C_1 and C_2, while the two other plates are connected together and with the second terminal p_o of the high-tension side of the transformer. The disk is revolved by means of a four-pole synchronous motor. The motor and the transformer are supplied with alternating current from the same source. One period of the alternating current corresponds, therefore, to half a revolution. Assume that in the moment when the voltage becomes a maximum the metallic rod E is in the position b_1b_3. The condenser C_1 is then charged. This charge remains when in the next moment the contact is broken. After half a period the metallic rod is in the position b_2b_4. The condenser C_2 is now charged. The voltage has the opposite value since the direction of the current has meanwhile been reversed. This occurs over and over again for each half period. In this way between the outer plates of the two condensers a voltage is soon produced which equals double the maximum value or 2.8 times the effective value of the alternating-current voltage employed. If the cable to be tested is now connected between A and B, it is subjected to the full direct-current voltage generated by the apparatus. In this way very high charges can be produced with a transformer of small capacity. An apparatus of this kind for practical use has been constructed by a French company. It is transportable on a hand wagon. In an additional note by L. Lichtenstein it is pointed out that with the increase of voltage used in cables the testing of the cables with alternating current is practically impossible when the emf reaches from 30,000 to 40,000 volts. If a test is to be made, direct current will have to be used and the method of Delon has therefore some practical interest.—*Elek. Zeit.*, Nov. 14, 1912.

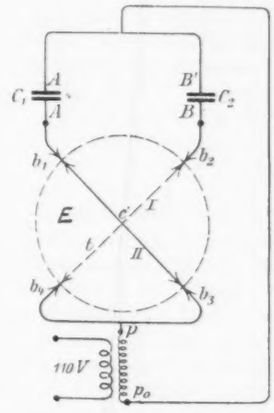


Fig. 2—Diagram of Connections for Testing Cables by Direct Current.

Magnetic Tests of Sheet Iron.—J. EPSTEIN.—Some three years ago the author showed that magnetic tests of sheet iron can be made in a very simple way in the testing apparatus devised by him. At that time Gumlich and Rogowski advised that the introduction of the author's apparatus

into practical use should be delayed and their own recommendations awaited. They have also described an apparatus of their own and given the results of measurements made with it. The present author points out that the Gumlich-Rogowski apparatus is considerably more complicated than his own and that the comparative measurements given do not show any higher accuracy.—*Elek. Zeit.*, Nov. 14, 1912.

Telegraphy, Telephony and Signals.

Automatic Telephone Exchanges.—G. H. Green.—A continuation of his long illustrated article on recent developments in automatic exchange telephone systems. Early suggestions for automatic telephony are referred to briefly and the fundamental principles underlying modern systems are described more fully. A detailed description is given of the circuits of the "three-wire" and "two-wire" Strowger systems, and reference is made to some features of interest in the Epsom and G. P. O. exchanges recently opened.—London *Electrician*, Nov. 15, 1912.

Fire Alarm.—W. Fellenberg.—A paper illustrated by various diagrams, describing the principal systems of fire alarm in use at present and giving wiring diagrams.—*Elek. Zeit.*, Nov. 14, 1912.

Miscellaneous.

Fortieth Anniversary of London Electrical Review.—An editorial on the fortieth anniversary of the appearance of the first issue on Nov. 15, 1872. It was first a monthly, but became a bi-weekly in six months and a weekly a few years later. The issue contains a congratulatory article entitled "Many Happy Returns," by Sir William H. Preece. The original title of the paper was *Telegraphic Journal*, and in January, 1873, the words *"and Electrical Review"* were added.—London *Elec. Review*, Nov. 15, 1912.

Presidential Address.—S. D. Schofield.—His presidential address to the Yorkshire Section of the (British) Institution of Electrical Engineers. With reference to the recent coal strike in England the author urges that a six months' reserve stock of coal in power plants is by no means excessive. Under certain conditions it is sound policy to supplement a coal reserve by storing low-grade oils. One of the many things to be considered in the future is the fixing of standard pressures and frequencies, since the day of the small supply stations is passing away. In many instances throughout England additional consumers have often been obtained by the readiness of central stations to step in and supply electrical energy at short notice, when the ordinary power units (steam or gas) have broken down. This statement is made to emphasize the point that "supply engineers should be always open for business, if there is a margin on the right side in it, even if it compels them temporarily to overload plant and mains. In these days of first-class plant and standardization there is a tendency to practise caution until it ceases to be a virtue."—London *Electrician*, Nov. 8, 1912.

Presidential Address.—A. A. Day.—His presidential address to the Manchester local section of the (British) Institution of Electrical Engineers. The object of the new articles of the association is to broaden out the aims of the institution. One of the directions in which the institution, perhaps in conjunction with the government, might work would be to aid the manufacturers to get an increased share in foreign trade, together with an increase in the home trade which must come. Owing to the way in which electrical supply has been developed in England, there are far too many generating stations, and to obtain the efficiency due to large outputs at good load-factors some of these will have to be converted, in whole or part, into substations. A reasonable degree of standardization should be aimed at. "If it is conceded that large generating stations, co-operation between existing systems of supply and uniformity of systems of supply as far as practicable, and at any rate in adjoining districts, are desirable, is it not within the scope of the institution to do anything toward attaining these objects eventually, and moving in that direction now? I believe it is." The author refers to very large power supply schemes and thinks that to arrive at a scheme of electrical supply like that indicated by Ferranti it is necessary that such a scheme should be carried on with government aid.—London *Electrician*, Nov. 8, 1912.

Reinforced Concrete.—E. Schick.—A review of the present knowledge of the relation between reinforced concrete and electricity, referring to the action of lightning discharges and of electric supply currents and telegraph and telephone currents on reinforced-concrete structures.—*Elek. Zeit.*, Oct. 31, 1912.

Platinum.—Harry F. Keller.—A Franklin Institute paper on "platinum, the most precious of the metals." After a brief historical sketch the author gives an outline of the different platinum minerals, methods of extraction and purification, the properties of platinum, its uses, possible substitutes, production and value. From 1902 to 1912 the price of platinum has increased from 75 cents to $1.70 per gram for crucibles and from 60 cents to $1.50 for wire.—*Journal of Franklin Institute*, November, 1912.

Accident in an Electric Bath.—An article on a recent accident in London in which a man was killed by a shock while he was being treated in an electric bath through which a current of 0.4 amp was passed. A diagram of the connections is given and it is shown that there were three possibilities of the patient receiving a severe shock. The need for supervision of electric bath establishments is pointed out. The design of the apparatus itself is said to be at fault and this is stated to be serious because the board is practically of standard type of which many are sold every year.—London *Elec. Eng'ing*, Nov. 14, 1912.

Book Reviews

The Freezing Point, Boiling Point and Conductivity Methods. By Harry J. Jones. Easton, Pa.: The Chemical Publishing Company. 75 pages, 15 illus. Price, $1.

The second edition of a very useful little book which gives a combination of the theory and the technique of the three important physical-chemistry methods of investigation by means of freezing-point, boiling-point and electric conductivity measurements on solutions. The treatment is thus the more interesting because the theory of the subject is elucidated by the technique while the practical measurements are explained theoretically. The volume will be of interest to all students of physical chemistry.

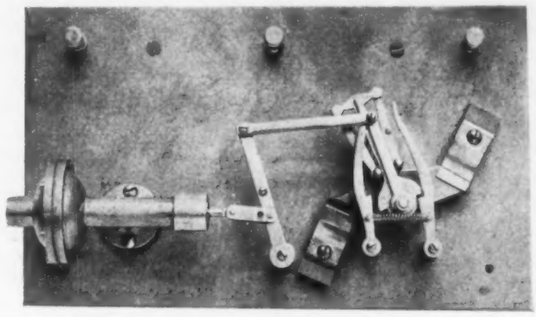
Efficiency as a Basis for Operation and Wages. By Harrington Emerson, New York: *The Engineering Magazine*. 254 pages. Price, $2.

The third and enlarged edition of a very entertainingly written book, which is neither a series of essays on industrial operations nor an engineer's textbook on costs of production in factories, but a kind of union of the two. Mr. Emerson writes in a very incisive and philosophic vein on matters of everyday manufacturing routine. His opinions may not be infallible, but they are always suggestive and stimulating. The book is divided into twelve chapters, dealing with the following topics: Typical inefficiencies and their significance; national efficiencies; the strength and weakness of existing systems of organization; line and staff organization in industrial concerns; standards; the realization of standards in practice; the modern theory of cost accounting; the location and elimination of wastes; the efficiency system in operation; standard times and bonus; what the efficiency system may accomplish; the gospel of efficiency. The volume will be of interest to the employer and the business man.

New Apparatus and Appliances

PRESSURE-CONTROL SWITCH.

The single-pole switch illustrated is arranged for the control of small motors driving air pumps, compressors, etc., and on account of its simplicity and dependability of operation has an especially useful application for the draw-



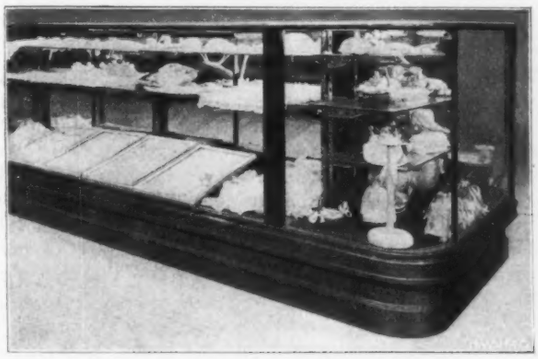
Pressure-Control Switch.

ing of beer and other liquids which are handled by compressed air. The sliding contact keeps the parts clean and free from dust or grit, and the construction insures against burning or corrosion. When the predetermined air pressure has been reached the switch is automatically opened. Again, when set for the minimum value the switch closes. The contacts are equipped with interlocks which prevent movement of the blade until the actuating piston and lever have operated. This switch is made by the Gorton Electric Switch Company, City Hall Building, St. Joseph, Mo., and can readily be attached to any pump operated by electric power.

SHOWCASE LIGHTING.

BY J. A. VESSEY.

It is difficult to understand why the average central-station man will jump at the opportunity afforded for lighting a few square feet of show windows when the showcases in most stores, presenting an area about ten times as great, are allowed to remain unlighted and neglected. In



Showcases in a New York Department Store.

a recently completed modern department store there were only 250 ft. of show windows, while the interior of the store contained an aggregate of nearly 4000 lineal ft. of cases, affording an opportunity for the sale of about sixteen times as much energy. While the average store does not have 4000 ft. of showcases, it does have sufficient to make a very inviting proposition.

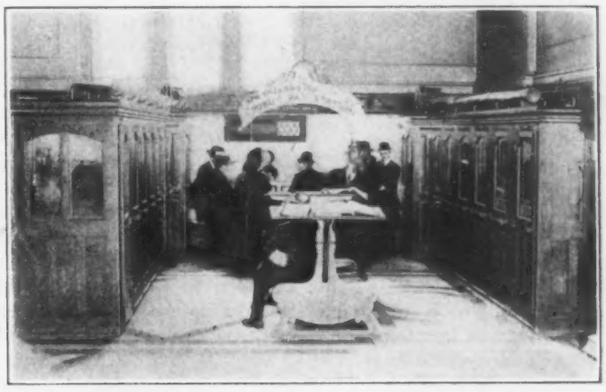
Probably the salesman would hesitate to believe at first reading that only from 25 per cent to 40 per cent of the stores use any showcase lighting at all. Furthermore, a large proportion of the percentage is most inadequately lighted. Ordinarily, four 25-watt lamps will suffice to light each 8 lineal ft. of case satisfactorily. But a very good rule to follow for proper showcase illumination is to fix it at approximately double the exterior general illumination. Experience has shown that an intelligent consideration of these two figures will enable any central-station solicitor to make recommendations that can be safely relied upon to secure desired results and assure in many instances much new business in a field which has as yet been only "scratched" on the surface.

One of the most recent methods for lighting showcases is the so-called Linolite system introduced by the H. W. Johns-Manville Company, New York, which consists of a tubular electric lamp nearly a foot long. These lamps complete with reflectors occupy a space only 5 in. deep by 2.5 in. wide and can be easily attached to or detached from the case by means of spring clips. These clips are readily adjusted to the interior of the showcase and firmly support the removable shell in its proper position.

An ornamental or plain stand-pipe or wire conduit is run down in a corner and through at one end of the case into an outlet box under the base of the case. A single-pole flush switch is usually provided for the outlet box so that the lamps of each case may be individually controlled when desired.

VENTILATING SYSTEM FOR TELEPHONE BOOTHS.

The accompanying illustration shows a ventilating system recently installed in the telephone booths of the South Station at Boston, Mass., by the B. F. Sturtevant Company of Hyde Park, Mass. The booths are arranged in groups of seven, and each group is supplied with air from its own plant, which consists of a motor-driven blower and a system of fiber piping. The whole equipment is placed on top of the booths, and the fiber pipe running the full length of the group supplies each booth with air through its own separate



Telephone Booths with Ventilating System.

discharge pipe. At the point where this pipe enters the booth it is fitted with deflectors especially designed to prevent the air from blowing upon the head of the occupant of the booth. A brass ventilator placed at the bottom of the inner door and one at the top of the outer door form an exit for the air through the dead-air space in the door, which offers considerable resistance to the transmission of

sound. The fan and motor operate so noiselessly that the occupant of the booth is not disturbed by them. The fan operates at 850 r.p.m., delivering 450 cu. ft. of air per minute, or 64 cu. ft. to each booth. There is a complete change of air in the booth about once in every minute.

STARTING SWITCHES FOR ALTERNATING-CURRENT MOTORS.

The Allen-Bradley Company, of Milwaukee, Wis., has recently added two more types of starting switches to its line of alternating-current motor-control equipment. These two patterns are being produced in different sizes and forms. The type shown in Fig. 1 is designed for starting small alternating-current motors and protecting them against no-voltage and overload conditions, and is intended for use with motors that can be connected directly to the line without a starting resistor to limit the current. These switches are inclosed in dust-proof cases and the switch contacts are immersed in oil, with copper electrodes between which the current is broken in free air. The facts that these switches are light and durable and may be placed to the best advantage without the use of much floor space, and that they are inclosed on all sides, make them especially well adapted to meet the service which is required in planing mills, textile mills and grain elevators, where inexperienced help must be protected and the fire hazard is great. This type is manufactured in four forms. Form 1 can be used with single-phase or polyphase motors, and can be arranged for reversing their direction of rotation. Only one movement is required to start the motor; that is, the handle is thrown from the "off" to the "running" position and is held there by a latch, which may be released to stop the motor. Under no-voltage or overload conditions two adjustable relays and a solenoid operate to release a weight which disengages the latch on the handle. It is claimed that the relays are not sensitive to spasmodic changes in current and operate only on a bona fide overload. Forms 2, 3 and 4 are smaller, lighter and cheaper designs of this pattern of switch.

The second type is a resistor switch designed for starting squirrel-cage induction motors rated at from 5 hp to 50 hp, for switching them into and out of the circuit and for protecting them against no-voltage and overload. The resistance units employed are of the graphite compression type and are so placed in each phase and equalized that the system remains balanced. To start a motor with this type of switch the handle, shown in Figs. 2 and 3, is pulled up, which raises the resistance units, makes contact between the copper and graphite electrodes at the top of each and closes the circuit to the motor. Raising the lever still farther increases the pressure on the resistors, which in turn increases the current and potential at the motor until energy enough is supplied to turn the motor over and accelerate it to full speed. When the starting lever has reached its highest point the resistors are automatically shunted out of the circuit. It is stated that this entire operation should not require more than fifteen seconds. This switch is equipped with a no-voltage and overload release which is actuated by adjustable relays in the same manner as the other type of switch.

Fig. 1—Starting Switch for Small Motors.

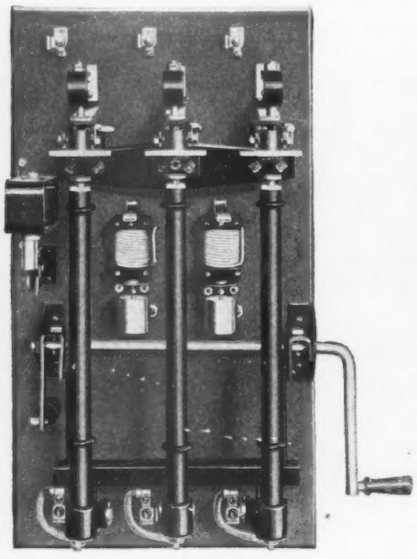


Fig. 2—Resistor Switch with Cover Removed.

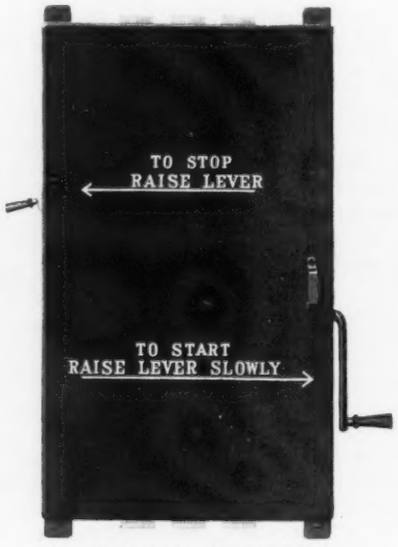


Fig. 3—Resistor Switch Closed.

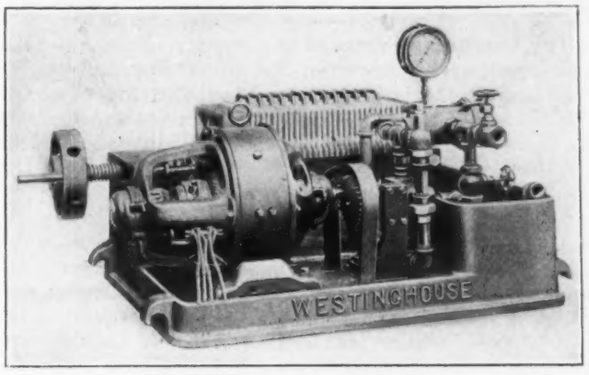
TUNGSTEN-ALLOY FILAMENT LAMP.

An incandescent lamp made of an alloy of tungsten called "wirum" has recently been placed on the market by the Brimsdown Lamp Works, Kingsway House, London, W. C., England. "Wirum" is a composition of tungsten and another metal the name of which has not been divulged. The alloy is claimed not only to possess the strength and efficiency of drawn tungsten but to withstand crystallization for a longer period. It is said also to retain its initial ductile strength during the life of the lamp. Lamps with filaments made of it have been subjected to very severe tests in railway and street-car service and in works where constant vibration is experienced, with excellent results. It is possible to obtain lamps with "wirum" filament for all standard voltages in sizes from 8 cp to 1000 cp. The smaller sizes are equipped with bayonet base and the larger sizes with screw base.

OIL-DRYING AND PURIFYING OUTFIT.

To obtain the best service as well as to economize in the use of oil for cooling and insulating transformers, high-tension switches, circuit-breakers, electrolytic lightning arresters and similar apparatus, it is necessary to employ some method of cleaning and dehydrating the oil from time to time. The transformer and switch oils now in use are generally stable chemically and are subject to only very

slight change due to chemical causes. Switch oils, however, from the nature of their service, suffer deterioration in time from the presence of carbonized particles of switch contacts and also of the oil itself. Both transformer and switch oils, moreover, are susceptible to moisture and even with the best care in handling and in operation will absorb water, though probably at a very low rate. Various abnormal conditions which occasionally arise, such as transformer burn-outs, accidents in cooling coils in water-cooled transformers and severe or improper operation of switches, may seriously impair the dielectric strength of the oil so that provision should be made for suitably treating the oil after such conditions. Carefully conducted tests have shown that the presence of from 0.001 to 0.005 per cent of moisture (one part in 100,000 to 20,000) will reduce appreciably the dielectric strength of oil below the standard test value of 30,000 volts between ½-in. spheres spaced 0.015 in. apart and 8 in. below the oil surface. Fine particles of carbon, dust or other foreign matter in suspension also reduce the dielectric strength and in addition form undesirable deposits, necessitating that the oil be kept free from sediment as well as moisture.



Oil-Drying and Purifying Outfit.

The Westinghouse Electric & Manufacturing Company has placed on the market a special type of filtering outfit for this service. In this outfit the oil is forced through several layers of specially prepared filter paper. The sediment is strained out by the first layer of paper and the moisture is taken up by the capillary action of the paper.

The complete outfit consists of filter press, motor, pump, oil strainer, pressure gage and piping, the whole mounted on a neat iron base cast with a high rim that forms an inclosure and serves as a drip pan. The filter press proper is made up of a series of flat cast-iron plates and frames, assembled alternately, with the filter papers between them. By means of a screw and lever and a movable cast-iron end block the plates, frames and papers are forced tightly together.

The oil enters under pressure at the top corner through the inlet in the frames and fills each of the chambers formed between each set of two filter packs. From these chambers there is an opening and the oil is consequently forced through filter papers that form the sides of the chambers. The filter paper thus takes up the moisture and screens the sediment from the oil. The filter paper is backed in each instance with a cast-iron plate with small pyramids covering its surface. This allows the flow of oil through the paper but still supports the filter paper.

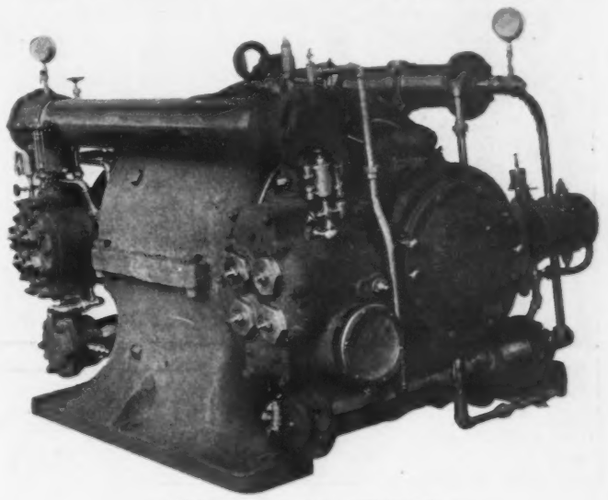
Motor-driven, rotary-gear, positive-pressure pumps are used for these outfits. A wire-mesh strainer arranged so that it may be easily removed for cleaning is connected in the piping to remove from the oil the larger particles of sediment before the oil enters the pump. A by-pass is connected around the pump and provided with a relief valve set for approximately 60 lb. pressure. If the pressure should rise to this value owing to clogging of the filter, the valve opens and allows a part of the oil to circulate back through the pump, thus relieving the pressure. These pumps will develop considerable suction, and the oil to be treated may be readily drawn from a tank below the level of the outfit.

An electric oven for drying the filter paper is generally used with the filter press. The oven is built of sheet iron with double walls and adjustable slides are provided in the top of the oven for regulating the temperature and the circulation of air. The heating elements used with these ovens are known as the bayonet type and consist of slotted ribbon resistance metal imbedded in pure sheet mica and covered by a sheet-steel shell. Standard outfits are made in two sizes; the large size has a normal filtering rate of from 10 to 12 gal. per minute, and the small size a normal filtering rate of from 2 to 3 gal. per minute.

MOTOR-DRIVEN AIR COMPRESSOR FOR TORPEDO SERVICE.

The accompanying illustration shows a self-contained motor-driven air compressor used by the United States government on battleships in connection with torpedo service. The compressor was designed by Mr. R. E. Allgire and built by the Platt Iron Works, Dayton, Ohio. It is of the four-stage, single-acting piston type, all cylinders and auxiliary receivers being mounted on the motor frame. The first-stage and fourth-stage cylinders are mounted on the commutator end of the motor, the second-stage and third-stage cylinders on the opposite side, counterbalanced cranks being provided on each end of the motor shaft.

The air entering the first-stage cylinder at atmospheric pressure and temperature is compressed to about 42 lb. pressure and passes thence to the first-stage cooler. In the following stages the air is compressed to approximately 225 lb., 875 lb., 2500 lb. or 3000 lb. per sq. in. respectively, being cooled between each cylinder to practically atmospheric temperature in the coolers through which it passes in going from one cylinder to the next. The highest temperature reached in the whole operation is not more than 290 deg. Fahr. The compressor cylinders are supplied with water jackets which help to preserve low operating temperatures, the circulation of the water being maintained by an attached pump of the rotary type which is driven directly from the main shaft.



Motor-Driven Air Compressor.

Careful attention has been given to the lubrication of the machine, both the splash and forced systems of lubrication being employed. Drains are provided for renewing the oil and for drawing off any water that may have become mixed with the oil. Provision is also made for

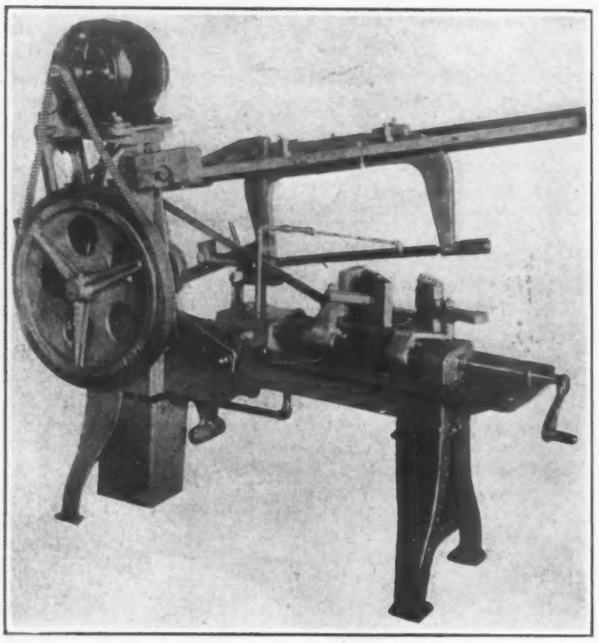
draining the coolers of each stage and for removing all cooling water from the cooling system in case the machine be allowed to stand idle in an exposed position where there is danger of the water's freezing.

The electric motor for the compressor was furnished by the Fort Wayne Electric Works of the General Electric Company. It is of the semi-inclosed type and is designed to carry its full rated load of 80 hp, continuously, with a speed of 500 r.p.m. when operating on 125 volts direct current. The motor is especially designed for the service, the armature being pressed upon the compressor crank shaft, the bonnets arranged to accommodate the mounting of the compressor parts, and the base being especially heavy to insure stability of the unit. The frame is divided horizontally to facilitate disassembling without removal of all the compressor parts.

At the official test the compressor delivered considerably more than the required 50 cu. ft. of air per hour at a pressre of 2500 lb. per sq. in. when running at rated speed. It also met the requirements of a half-hour's service at a pressure of 3000 lb. without undue heating, vibration, wear or other trouble.

ELECTRICALLY DRIVEN HIGH-SPEED HACK-SAW.

The accompanying illustration shows an electrically operated high-speed hack-saw which is manufactured by E. C. Atkins & Company, of Indianapolis, Ind., and electrically equipped by the Crocker-Wheeler Company, of Ampere, N. J. This saw is so constructed that it automatically adapts itself to the size of the work and utilizes the entire blade at each stroke. This effects a saving in blades, and this saving is further increased by the addition to the machine of a device which lifts the blade slightly above the work on the return stroke. In order to allow an increase in cutting speed a complete lubricating system is provided



Electrically Driven High-Speed Hack-Saw.

which keeps the blade cool and lengthens its life. A special attachment is also provided which makes it possible for work to be cut at an angle as great as 45 deg. In addition to this the machine is fitted with an automatic stop, an outside rest which holds the work in place until the cut is complete and a depth gage which automatically stops the saw at any desired depth.

The motor which is used to drive this saw is a ½-hp, 230-volt, 550-1100 r.p.m. direct-current machine. It is fitted with a regulator which gives an allowable change in speed of from 50 to 100 strokes a minute.

OUTDOOR HIGH-TENSION TRANSFORMER.

The Pittsburgh Transformer Company, Pittsburgh, Pa., has developed a noteworthy type of outdoor high-tension transformer. It is generally agreed that the oil-cooled transformer is most suitable for this service and to avoid the necessity of drying out before installation the outdoor transformer is shipped with the case filled with oil. The operation of installing is therefore reduced merely to placing the transformer in position and connecting to the circuit. Both the high-tension and the low-tension leads issue through weatherproof bushings located in the cover, thus securing a highly convenient method of connecting to both the incoming line and the load wires. The losses and radiation surfaces are so proportioned that low temperatures are maintained at all times, thus reducing to a minimum the danger of oil deposit settling on the elements or case and preventing proper cooling.

ELECTRIC HEATING OF OLYMPIA, LONDON, DURING MOTOR EXHIBITION.

At the eleventh international motor exhibition, which was held at Olympia, London, during the week commencing on Nov. 8, electric radiators were employed to heat the huge building housing the exhibition. This is said to be the largest trade exhibition ever held in the world, and it is also said that this was the largest undertaking in the line of electric heating ever attempted and successfully carried out. Electric radiators were decided upon as being most efficient in a place of such proportions and where draft is unavoidable. Radiant heat rays have the property of passing through air currents, heating any objects or persons within their range. The radiators employed were all of the same pattern, specially made by the General Electric Company, Ltd., London, for this occasion. Each radiator was equipped with four Robertson radiator lamps and copper reflectors. The bodies were constructed of sheet metal with a matte finish. Perfect control of the heat was accomplished through a simple switching arrangement.

COLORING FOR INCANDESCENT LAMP BULBS.

Heretofore great difficulty has been experienced in coloring the bulbs of incandescent lamps either because the coloring matter was too short-lived, or because it would crack from the expansion and contraction of the glass bulb, or because it actually shortened the useful life of the lamp itself by failing to radiate the heat properly. The Electric Sales Company, of Detroit, Mich., has recently placed upon the market a lamp lacquer which, it is claimed, will overcome all of these difficulties and make the coloring of lamp bulbs comparatively easy and economical. It is stated that, according to tests, the life of this lacquer is greater than the life of any incandescent lamp, that its coefficient of expansion is the same as that of glass, and that it has a high heat conductivity, insuring that it will not be a factor detrimental to the long life of the lamp. This product is now for sale in six standard colors, namely, amber, canary, red, blue, green and white, and it is possible by blending these colors to secure many other tints and shades. It is said that the cost of applying this lacquer is very reasonable.

Industrial and Financial News

ELECTRICAL TRADE CONDITIONS—II.

THE second set of replies which we have received from electrical manufacturers in response to circular letters requesting data on conditions in the electrical manufacturing field in 1912 appears in part below. As was the case with the first set of responses printed last week, the present instalment indicates that the year's results thus far have been highly satisfactory and that the outlook for next year is believed to be decidedly promising.

Many of the replies show that there was an unusual growth in volume of business during the current year, but that the percentage of profits received was not in proportion. Price-cutting competition is ascribed in most cases as the chief reason for this, while in some instances increase in the cost of raw materials is given as the cause. Most of the replies attribute the improvement in volume of business to the more settled condition of general trade during the present year. Other reasons given are the natural growth of the electrical industry and advance in design.

Confidence is expressed by the majority of manufacturers in the outlook for next year, and nearly all of the replies show that extensions and additions are being made to manufacturing facilities with a view to meeting the large demand which will be placed upon them. Uncertainty as to the retarding influence which may be exerted by radical tariff measures on the part of the administration seems to be regarded as the leading obstacle in the path of trade expansion next year.

INSULATING MATERIALS: (a) American Lava Company.—Our sales in 1912 were the largest in our history, but profits were smaller in proportion to the business done. The increase in sales was due to the general increase in the use of lava insulation and to improved conditions in the electrical industry. Profits were smaller because of competition. The outlook for 1913 is splendid. We will increase our capital from $20,000 to $50,000 in January, 1913.

(b) Hope Webbing Company.—Our business for 1912 shows an increase of 50 per cent over that in 1911. Profits remained nearly the same. We believe this was due to the increased demand for new electrical apparatus. As regards next year, we think that the outlook is good and that prices will be slightly higher. We are increasing the size of our plant.

(c) A New York Manufacturer.—We have had a substantial increase in business and profits this year, due to increased acquaintance in the trade and to the new lines we have added. We think that good prices and business will prevail next year if tariff changes are not too radical. We extended our works in 1912 and contemplate considerable expansion in our selling organization during 1913.

(d) An Eastern Manufacturer.—The volume of our business was better this year, but the profits were less. We attribute the gain in volume to increase in all manufacturing lines. We think the outlook in our field for 1913 is poor. The greatest drawback is tariff tinkering, from which there will be no relief for several years. We are not going to spend a cent on extensions to our plant and, in fact, are curtailing now.

(e) From the Same Section.—Our 1912 business has been larger in volume than that of 1911, but profits have been less. We attribute the latter to the price war among competitors. We regard the outlook for business as promising, but think that the chances for better prices are not very reassuring. There is nothing, in our opinion, to prevent a healthy growth. We have just completed large extensions and additions for producing vulcanized fiber of all kinds and a mill to produce our special insulating paper in rolls for armature winding.

(f) Another Eastern Manufacturer.—Our 1912 business has shown marked improvement in both volume and profits over our 1911 business. We attribute this increase to natural growth as well as to increasing understanding on the part of manufacturers of electrical appliances of the advantages to be derived from the use of our specialty. We consider the business outlook in our field for 1913 to be excellent. The principal drawback to expansion in this field is lack of standardization and co-operation between manufacturers. The remedy would seem to be the establishment of definite standards by the users. We do not contemplate any immediate extension of our works, though we will, of course, add to their capacity.

ELECTRICAL MEASURING INSTRUMENTS: (a) Leeds & Northrup Company.—Both volume and profits have been better this year than they were in 1911. The increase in volume has been due to normal growth, together with introduction of new and improved products. The increase in profits has been due to increased business and increased manufacturing efficiency. We regard the 1913 outlook as excellent.

(b) Hoyt Electrical Instrument Company.—Our business has shown an increase in volume this year of a little over 70 per cent and the margin of profit was very satisfactory. We attribute this to the flourishing condition of the country in general, due to the satisfactory crops of the past few seasons. As regards next year, we can see no cloud in the business sky as yet. We would not ask for a healthier condition in our line. Business is good, collections are good, and a reasonable margin of profit is easily obtained. We are very optimistic.

(c) Sangamo Electric Company.—Regarding business conditions during the past year as compared with those in 1911, we would say that, in addition to the general betterment found by all manufacturers, our company has experienced a growth rather out of the ordinary. The combination of new conditions, broader lines of manufacture and an extended sales organization has resulted in an increase of 90 per cent over that in 1911, and there is every indication that 1913 will show an equally good record. It is very improbable that the prevailing prices on meters will be increased, while the central-station industry will continue to receive the benefits brought about by new competition introduced by the recent patent expirations. By Jan. 1, 1913, large additions to our factory will be completed and in full operation. Early in the spring work will be started on a second addition which advance business now booked will fully warrant. In addition to the regular line of meters, we will also introduce during 1913 several entirely new lines of detail apparatus demanded by natural growth of the business.

ELECTRIC VEHICLES: S. R. Bailey & Company.—Prior to 1911 we had only one model, the victoria phaeton, and our business, although satisfactory, has not, of course, been very large under the circumstances. We have, however, been developing a roadster, and while our production of these cars was slow at first, we have put out a considerable number, so that our business during 1912 will be very close to two and one-half times that of 1911. We think the business outlook is excellent, and with our roadster, in two or three slightly different forms, we expect to do a very much larger business than we have ever done before. We think that the greatest drawback to expansion in our field is the great lack of knowledge of the public as to what may be expected of the modern electric. There is a very general feeling that the electric car is nothing but a vehicle for town use and that it is slow and entirely unsuited to the use of men. We have undoubtedly got to do a great deal of educational work to make people realize that our car is an ideal vehicle for men and capable of far greater speed and mileage than the ordinary person has any idea of.

CIRCUIT-BREAKERS: Cutter Electrical & Manufacturing Company.—Our 1912 business compares very favorably with that in 1911. We attribute this to the fact that the country has been running on about three-quarters time for five years. Good crops furnished the impetus for expansion. We think the outlook is fine and that business will be good if the new administration is not too radical. The greatest drawbacks are the activities of politicians. We are going to build a new factory and increase the number of our district offices.

WATER-POWER MACHINERY: The Trump Manufacturing Company.—Our 1912 business has been of greater volume with a tendency toward better prices than that of a year ago. We attribute these increases to a steadily growing demand for water-power machinery, due to the awakening of our country to the vast amount of energy stored up in natural resources. We are of the opinion that business in our particular line is steadily growing with a tendency toward better prices, owing largely to the demand for high-grade machinery. We consider that the greatest drawback in the water-power machinery field is the lack of co-operation on the part of the builders of this class of machinery. Together with this is a deep-rooted sentiment that water-power machinery, regardless of its efficiency or quality, should be purchased at a very low price. Water-power users have been slow to realize that each development confronts a builder of water-power machinery with a new and distinct problem, which means the disregarding of standard equipments. We do not believe that there is any other branch of manufacturing that requires so much study and invention for each particular case as does the manufacture of turbine waterwheels. Without co-operation on the part of the builders among themselves each individual builder is more or less handicapped. We feel, however, that gradually this condition will be viewed from a broader standpoint, with a tendency toward higher class development. We are not contemplating any extensions to our works at this time. We are, however, continually improving our work. We think that a little tariff trimming won't hurt.

OIL ENGINES AND REFRIGERATING MACHINERY: Our fiscal year ends June 30. Since July 1, we have had a slight increase in volume of business as compared with that in the same period last year and profits have been in about the same ratio. Business in this line in 1913 will depend largely upon prices of fuel oil, which affect our oil-engine business materially, and also upon the tariff, which affects many of our customers. The greatest drawbacks in our field are the difficulty of securing fuel oil at reasonable prices and timidity on the part of prospective purchasers about increasing their plants owing to uncertainty about the tariff. The remedy is plenty of fuel oil at low prices and the adoption of a sound and reasonable protective tariff.

MOTORS, GENERATORS AND APPLIANCES: (a) C. & C. Electric & Manufacturing Company.—This company, which took over the properties of the Garwood Electric Company on Sept. 3, reports having taken a number of orders since its organization and that its three-wire generator is meeting with success. It has also booked a number of orders for slow-speed motors in connection with steam-heating and ventilating systems. It reports a broad demand for its various specialties.

(b) A Middle Western Manufacturer.—This year's business shows a very nice increase over last year's. This has been due to general improvement in business conditions. We think that the outlook for 1913 is quite favorable. Radical congressional action is likely to disturb conditions. No extensions are contemplated.

GAS ENGINES: The Bruce-Macbeth Engine Company.—We are more than pleased with present business conditions. In fact, the last four months have shown a marked improvement over the corresponding period of the previous year. The prospects for the immediate future are of the best, and we cannot but believe that a similar condition will exist throughout the coming year.

RECIPROCATING ENGINES: Our 1912 and 1911 showing has been about the same. We expect some improvement in 1913. The greatest drawback in our line is too much competition. We are not contemplating any extensions or enlargements.

FIXTURES: (a) The Dale Company.—Our 1912 business compares very favorably with that of 1911 and shows a slight increase so far. We attribute this to a little more settled condition in general trade. We take a very optimistic view of future conditions. Prices, we think, will be more steady, but if any changes take place, they will be of an upward trend. Lack of co-operation we consider the greatest drawback to expansion in our field. If more of the "get together" spirit were manifested, it would mean a more healthy condition. We are constantly devising plans to increase general efficiency and endeavor to keep adding new products as fast as possible.

(b) A Middle Western Manufacturer.—An increase of 15 per cent is shown by our 1912 business over that in 1911. We attribute this to the increased activity of central stations. We think the outlook is good and that prices will be about the same. We are building a new plant in one of the large cities.

CYLINDER OIL: E. H. Kellogg & Company.—The volume of our business has increased very materially this year, and we expect profits in the same ratio, as most of our sales have been of the better grades of oil. This improvement has been due to an energetic sales campaign by our traveling representatives, backed by our ability to keep our promises. We think that the business outlook is very encouraging. As to prices, the results of the past few years have convinced us that thoughtful buyers are coming more and more to realize that the best goods are cheapest in the long run. The greatest drawback in our field is the purchasing agent who thinks that he is saving money when buying at the lowest price offered. We are continually improving our facilities and are gradually extending our European branches.

CHAIN DRIVES: Our 1912 business has shown an increase of 50 per cent in gross and of 30 per cent in net over returns in 1911. This has been due to more favorable business conditions. The prospects for 1913 are good for at least the first six months and, with favorable crops, this outlook will probably continue. We are putting up a four-story addition to our plant. We manufacture a specialty which is influenced only in a minor degree by the general business conditions, although anything like the 1907 panic affects us materially. Our trade, however, is so diversified that a general setback in one line of manufacture does not materially influence the whole.

HOISTS: As regards volume our business in 1912 and that in 1911 were about the same. In the first six months of the year profits were very small, but in the last half they have been much better, so that we think 1912 will show improvement over 1911. This has been due to more confidence in business circles and less dependence upon political conditions. We believe that there will be more business next year and that prices will advance. The greatest drawback in our field is too much competition from new concerns which do not have data as to costs. Time will remedy this as these new concerns get educated by losing money on their orders. We hope to extend our facilities in 1913.

REFILLABLE FUSES: Our business has increased from 200 per cent to 400 per cent over that in 1911. This has been due to improvements in design in the larger sizes. Prices will be a little higher, and the business outlook for 1913 looks better than the 1912 outlook did at this time last year. There is no great drawback in our field. The future looks very promising. We are making additions to our plant which will give it three times its present capacity. This work will be finished early in 1913.

FLASHERS: Phelps Manufacturing Company.—The volume of our 1912 business was double that of 1911 and profits were three times greater, owing to the large demand in our line. We think the outlook is good. Next year we will add 5000 sq. ft. more room, put in a nickel-plating plant and about one-half as much more machinery as we now have, and will make a number of new devices.

SOCKETS, RECEPTACLES: Harvey Hubbell, Inc.—Our 1912 business has been considerably in advance of that in 1911. We attribute this to the popularizing of electricity. The present outlook is favorable. The greatest drawback is the excessive cost of electric energy in certain localities where it is steam-generated. We have just completed a four-story concrete addition.

ANNUNCIATORS, SUPPLIES, ETC.: Business with us in 1912 and 1911 has been about the same in volume and profits. We are very optimistic as to 1913 and are continually expanding both in our floor space and the number of our products.

ELECTRIC SEARCHLIGHTS: This year's business has been about 30 per cent better than that of the preceding year. We think the outlook is good.

INDUSTRIAL AND FINANCIAL NOTES.

Receiver for Central Colorado Power Company.—G. H. Walbridge, 14 Wall Street, New York, president of the Central Colorado Power Company, has been appointed receiver for that concern, which is capitalized at $22,500,000. This action was taken in the United States District Court at Denver on Nov. 30, upon application of the Knickerbocker Trust Company, of New York, acting for bondholders under the first mortgage. The action was not unexpected, as it had been known for some time that the central-station company was not earning the 5 per cent interest on its first-mortgage bonds. A reference to this and to the fact that a reorganization of the company would be effected appeared in these columns Oct. 26. The company filed a mortgage in 1906 covering an issue of $10,500,000 first-mortgage bonds and subsequently filed a second mortgage for $1,303,050 to meet the interest on the first mortgage from Dec. 1, 1909, to June 1, 1912. In view of the foregoing and the fact that the company had permitted construction liens amounting to $115,000 to remain against it, the receivership proceedings were instituted. A reorganization plan providing for the formation of a new company with an authorized capital of $10,000,000 first-mortgage, thirty-year 5 per cent bonds, $4,000,000 7 per cent preferred and $15,000,000 common stock has been formulated by a protective committee that has been organized. The present capitalization, besides the bonds previously mentioned, consists of $15,000,000 common and $7,500,000 preferred stock.

Boston Edison Business Increasing.—Gross earnings of the Edison Electric Illuminating Company of Boston, Mass., for the month of October show an increase of 9.63 per cent over October, 1911, compared with an increase of 6.35 per cent in September, 1912. On account of the expenses incidental to the conduct of the 1912 Electric Show, which it is understood came to about $50,000 net, the net gain in October earnings was only $6,122, or about 2.2 per cent. For the four months of the fiscal year beginning July 1 the gross gain in revenue has been $141,524, or 8.62 per cent, and the net gain $30,817, or 3.39 per cent. During the present fall the company has had to meet an extraordinary demand for service from new customers. The slow but certain growth of the electric vehicle at Boston, the electrification of large industrial plants in the suburbs and the increasing use of electricity in building construction are all factors in the company's gains. The demand for additional distributing facilities in the outlying districts located within 20 miles of Boston has necessitated the establishment of new substation service, with improved regulation and efficiency of operation. The outlook for a large amount of extra lighting service during the coming holiday season is excellent.

November Incorporations Show Decrease.—The output of new companies in the Eastern States in November with an authorized capitalization of $1,000,000, including increases in capital, represented $154,200,000, according to compilation by the *Journal of Commerce*, New York, which compares with $174,495,000 in October, and with $150,593,400 in November a year ago. The grand total of all companies incorporated in November with a capital of $100,000 and over, including states other than those in the East, was $222,855,000, as compared with $362,158,400 in November, 1911. Among the large companies incorporated last month were: The Wisconsin Edison Company, $12,000,000; the Continental Gas & Electric Corporation, $7,500,000; the Idaho Consolidated Power & Utilities Company, $3,500,000; the American Telephone Fire Alarm Company, $5,000,000; the Montpelier-Barre Light & Power Company, $2,100,000; the National Electric Utilities Corporation, $1,000,000, and the Electric Tachometer Company, $750,000.

Siemens Companies Will Employ More Than 80,000 Persons by Jan. 1.—From a comparison made recently of the number of employees of some of the larger German concerns, it appears that the number of officers and employees of all classes of the Siemens concerns as of the end of July, 1912, was 75,908. For the Allgemeine Elektricitäts-Gesellschaft the corresponding figure was approximately 65,000, while the announcement of the Friedrich Krupp Company in connection with its centennial jubilee gave a figure of 71,221. A later enumeration shows still further growth in the number of employees of the Siemens companies, so that it is probable that by the end of 1912 the latter will be employing more than 80,000 persons.

American Public Utilities Offering.—The American Public Utilities Company, through a syndicate of brokers, is offering $2,200,000 6 per cent preferred and $770,000 common stock. The new stock has been issued for the purpose of acquiring $2,000,000 par value common stock of the Merchants' Public Utilities Company of Indianapolis, $299,000 par value common stock of the People's Light & Heat Company of Indianapolis, and $450,000 par value common stock of the La Crosse (Wis.) Gas & Electric Company, and to furnish more working capital. A list of the public-utility properties taken over by the American Public Utilities Company appeared in these columns June 24.

J. G. White & Company, Inc., Secures Argentine Contract.—Telegraphic advice has just been received by J. G. White & Co., Inc., of the award to their London associates, J. G. White & Company, Ltd., of railroad construction work in the Argentine, amounting to about $4,000,000, from clients for whom they have carried out several previous contracts. This new contract, like the others, will be on the usual basis of cost plus a fee. The railroad to be constructed constitutes the connecting link in the through system between Brazil and the Argentine Republic, with terminals at Buenos Aires and Rio de Janeiro.

Kings County (N. Y.) Electric Light & Power's New Bond Issue.—Stockholders of the Kings County (N. Y.) Electric Light & Power Company have authorized the issuance and sale of not exceeding $5,000,000 par value of convertible 6 per cent debenture bonds dated on or about March 1, 1913, and due March 1, 1925. These bonds are to be convertible at par into capital stock of the company after three years and within twelve years from the date thereof. When issued from time to time, they will be offered to stockholders of the company at par in proportion to their holdings of stock.

Henry L. Doherty & Company Acquire St. Joseph (Mo.) Utility.—A majority of the $3,500,000 common stock of the St. Joseph (Mo.) Railway, Light, Heat & Power Company has been purchased by Henry L. Doherty & Company from E. W. Clark & Company for $60 a share. The same terms have been offered to all stockholders depositing their stock with E. W. Clark & Company. The new owners will take over the property as of Feb. 1, 1913. The St. Joseph company has $1,560,000 5 per cent preferred stock, $3,500,000 common stock and $4,716,000 first-mortgage bonds outstanding.

Allis-Chalmers Business.—We said in our issue of Nov. 23 that representatives of the Allis-Chalmers Company stated that business was improving with that concern and that contracts aggregating 68,500 kw were closed by it in October. We have been informed that this statement should have been attributed to representatives of that company in the Pittsburgh-Cleveland district and that in that district alone contracts aggregating 68,500 kw were closed in October.

Pennsylvania Utilities Merged.—The Monongahela Light Company and the Oakmont & Vernon Light, Heat & Power Company have been merged into a new company known as the Duquesne Light Company of Pittsburgh, with a capital of $541,000. M. B. Starring, New York, is president, and J. G. Splane, J. S. Weller, J. J. Heard and R. T. Russell, of Pittsburgh, are directors.

Montreal Light, Heat & Power Earnings.—In the six months ended Oct. 31 the Montreal Light, Heat & Power Company showed a surplus over all charges of about $171,000 in excess of that shown in the corresponding period of 1911. The increase is equivalent to about 1 per cent on the company's outstanding stock, or at the rate of 2 per cent per annum.

Doubles Its Capital Stock.—Notice has been filed with the New York Secretary of State by the Southwestern Telegraph & Telephone Company that it has increased its capital stock from $20,000,000 to $40,000,000, has extended its corporate existence to be perpetual and has increased the number of its directors from seven to fifteen.

American Public Service Company Acquires Texas Properties.—The American Public Service Company, which was incorporated in October and recently increased its authorized capitalization to $15,000,000 preferred and $10,000,000 common stock, is to be a holding company for gas and electric properties in Texas, Louisiana and Oklahoma controlled by N. W. Halsey & Company and associates. It has taken over the gas, electric, water and ice properties in Abilene, Tex., that were recently acquired by N. W. Halsey & Company, as noted Oct. 26, and were formerly operated by the Abilene Light & Water Company, the Abilene Gas, Light, Fuel & Power Company and the Abilene Ice Company.

National Electric Signaling Company to Furnish Wireless Service.—We are informed by the National Electric Signaling Company that it expects to start actively in the commercial operation of wireless telegraphy, and that by early spring it will probably be in a position to offer service under attractive conditions. The company operates under the Fessenden patents. A large number of Fessenden sets are in use in the United States Navy, including several high-power sets such as those at Arlington, Va., Key West, Fla., and Colon.

Approved Sale of Ohio Property.—The Ohio Public Service Commission has approved the sale of the Miami Light, Heat & Power Company, of Piqua, Ohio, to the Dayton (Ohio) Power & Light Company. As was stated in these columns Oct. 26, the latter has been awaiting this approval, prior to inaugurating an active new-business campaign in Piqua.

Increases Its Common Dividend.—The Northern Ohio Traction & Light Company has declared a quarterly dividend of 1¼ per cent on its common stock, payable Dec. 15 to stock of record Nov. 30. This rate represents an increase of one-quarter of 1 per cent quarterly and places the stock on a 5 per cent per annum basis.

NEW YORK METAL MARKET PRICES.

	Nov. 25 Bid.	Nov. 25 Asked.	Dec. 3 Bid.	Dec. 3 Asked.
Copper:				
Standard, spot	17.05	.....	17.10	.....
	£ s d		£ s d	
London, standard, spot	76 15 0		76 13 9	
Prime Lake	17.60 to 17.70		17.65 to 17.70	
Electrolytic	17.50		17.50 to 17.60	
Casting	17.25 to 17.35		17.35 to 17.40	
Copper wire, base	19.00		19.00	
Lead	4.50		4.35	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	9.00		9.00	
Spelter, spot	7.50		7.40	
Tin, spot	49.25		49.50 to 50.00	
Aluminum:				
Prompt delivery	26.00 to 26.50		26.25 to 26.75	
Future	25.50 to 26.00		26.00 to 26.50	

OLD METALS.

Heavy copper and wire	16.00	16.00
Brass, heavy	10.00	10.00
Brass, light	8.75	8.75
Lead, heavy	4.30	4.30
Zinc, scrap	6.12½	6.12½

COPPER EXPORTS IN DECEMBER

Total tons to Dec. 4 2,180

INDUSTRIAL SECURITIES.

Security.	Capital Stock Listed.	Dividend. Per Cent.	Dividend. Period.	Quotation. Nov. 26	Quotation. Dec. 6.
Allis-Chalmers, 2d assess. paid	$17,151,100	.....	.....	2⅜*	2⅜*
Allis-Chalmers, pf., 2d assess. paid	14,034,700	.....	.....	10*	8½*
Amalgamated Copper	153,887,900	1	Q	84⅜	82⅛
American Tel. & Tel.	334,712,300	2	Q	142⅜	142
Crocker-Wheeler, c.	1,700,000	1½	Q	85*	85*
Crocker-Wheeler, pf.	500,000	1¾	Q	105½*	105½*
Electric Storage Battery, c.	16,074,425	.....	.....	54½	54½
General Electric	77,726,700	2	Q	184	183½
Mackay Cos., c.	41,380,400	1¼	Q	85½*	85½*
Mackay Cos., pf.	50,000,000	1	Q	68*	68*
Western Union Tel.	79,943,400	¾	Q	79⅛	77½
Westinghouse, E. & M., c.	31,685,300	1	Q	81	80¾
Westinghouse, E. & M., pf.	3,998,700	1¾	Q	123*	123*

*Last price quoted.

ELECTRIC SECURITIES.

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security.	Outstanding.	Dividend. Per Cent.	Dividend. Period.	Last Quotation. Bid.	Last Quotation. Asked.
Adirondack Electric Power, c.	$9,500,000	.....	.....	22½	23½
Adirondack Elec. Power, pf.	2,500,000	.....	.....	65	67
Amer. Gas & Electric ($50), c.	2,500,000	1¾	Q	85	90
Amer. Gas & Electric ($50), pf.	1,537,500	1½	Q	46½	47½
Amer. Light & Traction, c.	10,395,400	2½	Q	430	435
Amer. Light & Traction, pf.	14,236,200	1½	Q	109	112
Amer. Power & Light, c.	5,631,400	.....	.....	65	69
Amer. Pwr. & Lt., 6% cum pf.	3,106,800	1½	Q	85½	86
Amer. Pwr. & Lt., opt. warr.	1,604,000	.....	.....	13	15
Amer. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	99	100
Appalachian Power, c.	6,000,000	.....	.....	25	26
Appalachian Power, pf.	2,180,000	.....	.....	76	77
Arizona Power, c.	3,000,000	.....	.....	12	13
Arizona Power, pf.	850,000	.....	.....	50	55
Asheville Light & Power, 1st s. f. 5s, '42	1,100,000	2½	S	93	96
Augusta-Aiken Railway & Electric, s. f. 5s, '35	2,588,000	2½	S	90	94
Augusta-Aiken Ry. & Elec., c.	2,250,000	.....	.....	23	35
Augusta-Aiken Ry. & Elec., pf.	1,500,000	1½	Q	75	85
Augusta Railway & Electric, 1st 5s, '40	967,000	5	A	100	....
Butte Electric & Power, c.	4,037,000	1¾	Q	196	198
Butte Electric & Power, pf.	1,000,000	1¼	Q	87½	93
Butte Elec. & Pwr., 1st 5s, '51.	4,283,000	2½	S	95	97½
Central Maine Power; 1st 5s	1,923,000	5	A	97	99
Cities Service, c.	5,499,430	½	M	111	116
Cities Service, pf.	10,195,360	½	M	87	89
Columbus Railway Gas & Electric, 1st 5s, '36	2,454,000	2½	S	93½	95½
Columbus Ry., G. & Elec., c.	2,000,000	.....	.....	60	....
Columbus Ry., G. & Elec., pf.	840,000	1½	Q	85	95
Commonwealth Edison, cap. stock	32,964,800	7	A	143½	....
Consolidated Gas, Electric & Power (Baltimore), 4½s	11,564,000	2½	S	88	88⅞
Consum. Pwr. (Mich.), 5s, '36.	8,407,000	2½	S	96	98
Consumers Power (Minn.), 1st 5s, '29	9,528,000	2½	S	89½	92
Dallas Elec. Corp., 5s, '22	3,659,000	2½	S	95	98
Denver Gas & El. Lt., c.	7,001,300	½	M	220	....
Denver Gas & El. Lt., gen. 5s.	6,000,300	2½	S	95	97
Empire District Electric, 5s.	1,925,000	2½	S	87	88
Edison El. Ill. of Boston, cap. stock	15,603,700	2½	Q	284½	....
Federal Light & Traction, c.	4,750,000	.....	.....	34	36
Federal Light & Traction, pf.	2,500,000	1½	Q	81½	83½
Kings County El. Lt. & Pwr.	10,000,000	2	Q	130	132
Niagara Falls Power, 5s, '32.	10,000,000	2½	S	101½	102½
Northern Ohio Railway & Light, 4½s, '35	17,544,000	2¼	S	86	87½
Northern States Power, c.	5,975,000	.....	.....	26⅞	28
Northern States Power, pf.	8,386,700	1¼	Q	87⅛	89⅛
Pacific Gas & Electric, c.	31,908,750	1¼	Q	65⅜	65½
Pacific Gas & Electric, gen. and ref. 5s, '42	20,000,000	2½	S	91½	91½
Pacific Gas & Electric, pf.	10,000,000	1½	Q	91½	92
Philadelphia Electric ($25)	24,987,750	1½	Q	23	23⅛
Portland General Electric, 5s.	8,000,000	2½	S	100½	102½
Republic Railway & Light, c.	5,200,000	.....	.....	25½	27
Republic Railway & Light, pf.	6,360,000	1½	Q	81	82½
St. Joseph's R., L., H. & P., 5s.	4,637,000	2½	S	98½	100
Seattle ElectricCo., con. 5s, '29.	7,417,000	2½	S	98	100
Southern Calif. Edison, 5s, '39.	9,975,000	2½	S	96	98
Southern Power, 5s	4,000,000	2½	S	100	101
Standard Gas & Elec. ($50), c.	9,343,150	.....	.....	$21	$23
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	$50½	$51
Tennessee R., L. & Pwr., c.	20,000,000	.....	.....	23	24½
Tennessee R., L. & Pwr., pf.	10,250,000	1½	Q	76½	77½
Tri-City Railway & Light, c.	9,000,000	.....	.....	56	59
Tri-City Railway & Light, pf.	2,826,200	1½	Q	94½	95½
Tri-City Ry. & Lt., 5s, '23.	8,207,000	2½	S	97¾	....
Western Power	14,670,000	.....	.....	26	27½
Western Power, 6% cum. pf.	6,000,000	6	A	53	55½

Personal

Mr. C. E. Lasher has resigned as contract agent and chief engineer of the Milford (Mass.) Electric Light & Power Company.

Mr. C. C. Ousley has been appointed assistant to President R. E. Hughes of the Kentucky Electric Company, Louisville, Ky.

Mr. Edward J. Neary, formerly instructor in electrical engineering at the University of Pennsylvania, has joined the staff of Messrs. H. L. Doherty & Company, New York.

Mr. G. R. Cardinal recently left Schenectady for the Pacific Coast, where he will act as specialist on heating devices and fan motors for the Pacific States Electric Company.

Mr. Thomas Sproule, of the Philadelphia Electric Company and member of the N. E. L. A. committee on overhead-line construction, delivered a lecture on street lighting before the merchants of Chester, Pa., on Nov. 20.

Mr. Leonard Work has resigned as engineer in the Philadelphia office of the Westinghouse Electric & Manufacturing Company and taken up work with the Isthmian Canal Commission at Pedro Miguel, Canal Zone, Panama.

Mr. Charles Munson, who for eight years has been superintendent of the Cedar Rapids & Iowa City Interurban Railway, has been appointed manager of the properties of the Iowa Railway & Light Company at Marshalltown, Ia.

Mr. Lincoln Nissley, of the engineering department of H. M. Byllesby & Company, read a paper on "High-Voltage Transmission Lines" at the November meeting of the Minneapolis Section of the American Institute of Electrical Engineers.

Mr. D. E. Weddersheim, formerly superintendent of the gas department of the Oregon Power Company, Eugene, Ore., has become associated with the new-business department of the Western States Gas & Electric Company, Stockton, Cal.

Mr. A. H. Halloran, vice-president and managing editor of the *Journal of Electricity, Power and Gas,* San Francisco, Cal., has been appointed Statesman of the Jovian Order for San Francisco by Mr. Frank E. Watts, of New York City, the eleventh Jupiter.

Mr. John Anderson, assistant chief engineer of the Union Electric Light & Power Company, St. Louis, Mo., has been appointed engineer in charge of power plant of the Milwaukee companies of the North American Company to succeed Mr. C. A. Cahill.

Mr. Chauncey D. Parker, of C. D. Parker & Company, Inc., Boston, has been elected a trustee of the Massachusetts Lighting Companies, to serve for a period of four years. Mr. Bowen Tufts, also of Parker & Company, was elected to serve as trustee for two years.

Mr. James A. Fleet, superintendent and manager of the electric light and power division of the Cumberland County Power & Light Company, Portland, Maine, has resigned his position, to take effect Dec. 21. Mr. Fleet was formerly in the employ of Messrs. J. G. White & Company.

Mr. J. I. Mange, vice-president of the Ithaca (N. Y.) Electric Light & Power Company, will also act as general manager of the company hereafter, filling the position vacated by Mr. Thomas W. Summers. Mr. Mange will also act as general manager of the Ithaca Gas Light Company.

Mr. W. D'A. Ryan, illuminating engineer of the General Electric Company, has been invited to advise on the lighting plans for the Panama-Pacific Exposition. It was erroneously stated in our Nov. 16 issue that Prof. H. J. Ryan, of Stanford University, would design the illumination of the exposition.

Mr. Gordon Kribs, for the past two years assistant to the chief engineer of the Pacific Power & Light Company of Portland, Ore., has recently become associated in the same capacity with the Texas Power & Light Company, of Dallas, Tex. Mr. Kribs is a member of the American Institute of Electrical Engineers.

Mr. Nicholas Prakken has been appointed Chicago manager for the Shepard Electric Crane & Hoist Company, of Montour Falls, N. Y., with a Chicago office at 630 People's Gas Building. Mr. Prakken was formerly connected with the Chicago sales staff of the Sprague Electric Works.

Mr. Herbert Markle, formerly manager of the Consumers' Power Company, of Stillwater, Minn., has been transferred to Bluefield, W. Va., where he will become general manager of the Appalachian Power Company, which is owned by the same interests. Mr. Markle succeeds Mr. H. W. Fuller, who has been transferred to Louisville, Ky.

Mr. George A. Orrok, mechanical engineer of the New York Edison Company, has been chosen to deliver a lecture on power-house design before the students' section of the American Society of Mechanical Engineers at the Polytechnic Institute of Brooklyn on the evening of Dec. 7. The lecture will be illustrated and will be devoted chiefly to hydroelectric generating stations.

Mr. H. W. Fuller, who for a number of years was general manager of the Washington Railway & Electric Company, Washington, D. C., and for the past year was manager of the Appalachian Power Company at Bluefield, W. Va., has had general supervision over the Louisville (Ky.) properties of Messrs. H. M. Byllesby & Company given to him. He will relieve General G. H. Harries of much of his work.

Mr. George E. A. Fairley, a Baltimore consulting engineer, was appointed last week assistant engineer to Mr. Chief Raleigh H. Thomas of the subway commission of Baltimore. He succeeds **Mr. George B. Roberts,** who resigned several months ago, and will assist in the preparation of the plant for the extension of the conduit system out of the $2,000,000 loan approved by the Baltimore voters at the last election.

Mr. Emerson McMillin, chairman of the board of directors of the American Light & Traction Company and well known in public-utility circles, is the donor of the large seismograph recently installed in the American Museum of Natural History in New York City. The earthquake recorder was made in Germany and was presented by Mr. McMillin to the New York Academy of Sciences, of which he is now president.

Mr. Allen E. Ransom, formerly manager of the industrial power division of the Seattle (Wash.) office of the Westinghouse Electric & Manufacturing Company, is now assistant general manager of the Olympic Power Company, Port Angeles, Wash., where he is associated with **Mr. Thomas T. Aldwell,** vice-president and general manager. Mr. Ransom has had a varied experience, having been associated with several important engineering undertakings in Montana, Idaho and other states. He is a graduate of the Sheffield Scientific School of Yale University, class of 1897, and is an associate member of the American Institute of Electrical Engineers.

Mr. Parker H. Kemble, general sales manager of the Toronto Electric Light Company, Toronto, Ontario, has been appointed Jovian Statesman for Ontario. Mr. Kemble was recently elected first vice-president of the Canadian Electrical Association, to succeed Mr. Bird, who became president on the removal of Mr. R. F. Pack to Minneapolis, Minn. Since going to Canada Mr. Kemble has taken a deep interest not only in the Canadian Electrical Association but also in the Toronto Branch of the American Institute of Electrical Engineers, the Canadian Society of Civil Engineers, and many other organizations with which he is identified.

Mr. Sam A. Hobson was the guest of honor at a farewell banquet given to him at the Mercantile Club in St. Louis by the League of Electrical Interests of that city on Nov. 29. Mr. Hobson is the president of the League of Electrical Interests of St. Louis, and during his six years' residence in that city has won the high regard of electrical men by his successful efforts to bring about a greater degree of co-operation among the men engaged in electrical work. Since Dec. 1 Mr. Hobson has been Western manager of the *Electrical World,* with office in Chicago. At the farewell dinner Mr. W. A. Layman acted as toastmaster, and laudatory speeches were made by Messrs. Fred B. Adam, F. D. Beardslee, Ell C. Bennett, Fred John-

son, G. E. Cullinan, Walter Robbins and A. C. Einstein. Engrossed resolutions expressing appreciation of Mr. Hobson's worthy traits of character were presented to the guest of the evening, who was also the recipient of a handsomely mounted walrus-leather traveling bag. Coincident with the dinner a box of roses was sent to Mrs. Hobson, and later all the flowers with which the tables were adorned were added to this floral tribute.

Mr. W. H. Atkins, general superintendent of the Edison Electric Illuminating Company of Boston, Mass., celebrated the twenty-fifth anniversary of his connection with the organization on Dec. 2 at his headquarters in the Edison Building. Scores of friends called during the day to extend their best wishes, and a feature of the occasion was the receipt of a new disk phonograph from employees of the operating bureau containing a congratulatory message from Mr. Thomas A. Edison, who expressed the hope of being able to felicitate Mr. Atkins a quarter of a century hence upon his fiftieth anniversary of Edison affiliation. The phonograph also contained records of a presentation speech and an address of congratulation from employees of the Edison company. Mr. Atkins' electrical career began in Boston in 1884, when he entered the employ of the New England Wiring Company as a helper. He joined the Boston Edison Company's staff on Dec. 1, 1887, as an inspector, and rapidly rose to executive responsibilities, becoming superintendent of the company in 1890 and general superintendent in 1897. To Mr. Atkins is due the credit for many of the most successful commercial development movements of the company, and to his advanced ideas and modest, forceful direction of their execution may be ascribed in no small measure the great increase in the popularity of electric service and the growing good will of the public observed in recent years throughout the company's expanding territory.

Mr. R. S. Orr, general superintendent of the Allegheny County Light Company, Pittsburgh, Pa., member of the executive committee of the National Electric Light Association and past-president of the Pennsylvania Electric Association, was married recently in Pittsburgh to Miss Beryl Riggs, of that city. Mr. Orr was born Oct. 14, 1867, in Clarion County, Pa., and is a graduate of Washington and Jefferson College. For two years after his graduation he taught in the Washington and Jefferson Academy, leaving that institution to become principal of the Ninth Ward public schools of Allegheny. About February, 1904, Mr. Orr forsook teaching as a profession and became general contracting agent of the Allegheny County Light Company. Within a short time he was made acting superintendent and less than a year afterward was promoted to the post of general superintendent, a position which he has since filled with credit to himself and his company. Mr Orr effected many improvements in the service and is the inventor of a method of reinforcing decayed wooden poles with concrete, used extensively throughout the country by telephone, railway and lighting companies. He is a member of the Engineers' Society of Western Pennsylvania and of the American Electrochemical Society and an associate member of the American Institute of Electrical Engineers.

R. S. ORR.

Mr. Horatio A. Foster delivered an address before the New York Electrical Society on Nov. 25, on "Reminiscences of an Electrical Engineer." Mr. Foster was born at Bustleton, Pa., on Jan. 12, 1858. His electrical engineering began in the fall of 1884, with the Daft Electrical Company. On April 1, 1885, he was sent to Baltimore to electrify a short branch for the Baltimore Union Passenger Railway Company. This road, which was started in August, 1885, is said to have been the first commercial electric railway placed in operation in the United States. Later he became connected with the Thomson-Houston Electric Company at Lynn, Mass., and after a very short course in what was then known as the expert department, he was sent out on the road to repair some lighting installations. After a short time he was sent to Maine as an agent, but, not being a salesman nor having any taste in that direction, he did not succeed very well and subsequently returned to Lynn, where he obtained a position in the street railway motor department. After a short experience in the testing department he was sent to Philadelphia as a repairer of Thomson-Houston arc-light machines. In the fall of 1888 he was appointed superintendent of the East River Electric Light Company of New York City, remaining with that company and its successors until July, 1891. At this date he was appointed expert for the United States Census Office, for compiling data on the electrical industry of New York State, which was the only state in the Union taking an electrical census in 1890. During the following year he visited every central station in the State and most of the 500 or 600 isolated plants in existence at that time. In May, 1893, he accepted a position in the editorial department of a technical journal, known as *Electrical Industries,* becoming its editor for the World's Fair in Chicago. Late in that year Mr. Foster became associated with Prof. George Forbes, then the electrical engineer of the Niagara Falls Power Company, and retained this connection for about a year and a half, having charge of his New York office. Early in 1895 Mr. Foster became associated with the Cataract Construction Company, of Niagara Falls, as testing engineer for determining the cost of steam power, which work occupied about a year and a half. After some years of general practice as consulting engineer, Mr. Foster was in 1901 appointed receiver of a brewery trust in Philadelphia which had failed. During this period he had also several important engineering undertakings, one of which was the valuation of land for 10 miles along both sides of the Susquehanna River; in 1906 he became associated with Mr. L. B. Stillwell, having direct charge of his work in Baltimore for a year and a half, during which time he built new generating stations and substations and enlarged some of the old ones. In 1898 he became associated with Mr. Bion J. Arnold, Chicago, in his valuation work, making appraisals of the property of the Metropolitan Traction Company in New York City, the Detroit United Railway Company and the Southern California Edison Company at Los Angeles. Since that time Mr. Foster has been working on valuation of public utilities and studying traffic conditions and other matters pertaining to public service. Mr. Foster is the author of two books, "Handbook for Electrical Engineers" and "Valuation of Public Utilities," and has frequently contributed to the technical press.

Obituary

Hon. Samuel W. Emery, chief counsel for the Rockingham County Light & Power Company, of Portsmouth, N. H., the New Hampshire Electric Railways and other public utilities, died suddenly at his summer home in Portsmouth on Nov. 29. Mr. Emery was fifty-eight years of age and a graduate of the Harvard Law School, with a political record including service in the New Hampshire Legislature.

Mr. George A. Kimball, for the past fifteen years chief engineer of elevated and subway construction of the Boston Elevated Railway Company, died suddenly at his home in Arlington, Mass., on Dec. 3, after an illness of about two days. Mr. Kimball was one of the best-known civil engineers in the electric transportation field and had charge of the building of the original elevated lines in Boston in 1901, including much preliminary work in connection with the building of the Lincoln power station and the selection of multiple-unit equipment for the train service. He was born in 1850 in Littleton, Mass., and was educated at Appleton Academy, New Ipswich, N. H., later becoming city engineer of Somerville, Mass., and a member of the Metropolitan Sewerage Commission at Boston. He was a director of the American Society of Civil Engineers and was frequently in demand as an expert.

Construction.

BENTON, ARK.—C. C. Kavanaugh, of Little Rock, and associates, who have obtained controlling interest in the Garland Pwr. & Devel. Co., which controls water powers on Ouachita River, propose to construct a large dam in Garland County, about 45 miles from Little Rock, to furnish power for a hydroelectric plant which will supply electricity for the central and southwestern central section of the State. Two other dam sites have been secured from the Garland Co., and Mr. Kavanaugh has options on controlling interests in Polk water-power sites above navigation on Ouachita River. Electricity generated at the first dam will be distributed within 100 miles of Little Rock. The company contemplates supplying electricity to rice growers in Lonoke, Prairie and Arkansas Counties and also to a large bauxite developing company in Saline County. The cost of the hydroelectric plant and transmission system is estimated at about $3,000,000. About 28,000 hp will be developed. The new officers of the Garland company are: C. C. Kavanaugh, president; W. M. Kavanaugh, vice-president and treasurer, and D. H. Cantrell, secretary, all of Little Rock.

LITTLE ROCK, ARK.—The board of directors of the Fourche Drainage District has instructed Lund & Hill, engineers of the district, to prepare plans and advertise for bids for the installation of a pumping plant to be erected at the lower end of the district. Estimates are to be made both for the use of steam and electricity. The cost of the work is estimated at about $100,000.

BANDSBURG, CAL.—Arrangements are being made to equip the King Solomon Mine with electric hoisting equipment as soon as the substation of the Southern Sierras Pwr. Co. is prepared to furnish the electrical service.

CHICO, CAL.—The State Railroad Commission has granted the Northern El. Ry. Co. permission to issue $10,829,000 in bonds, the proceeds to be used for the extension of its electric railway from Sacramento to Vallejo, a distance of about 60 miles. The company will also build a link to connect its present system north of Sacramento with the electric railways now radiating to the northeast of Oakland.

EL SEGUNDO, CAL.—The City Trustees are considering the installation of a street-lighting system here. Series tungsten lamps will probably be used. Bids, it is said, are wanted for poles and detail material.

FRESNO, CAL.—Preliminary surveys are being made by the San Joaquin Lt. & Pwr. Co. for water-power and ditch lines near Crane Valley, where it proposes to build the No. 2 unit of its power houses.

GLENDORA, CAL.—An election will be held on Dec. 11 to vote on the proposition to issue $40,000 in bonds, of which the proceeds of $10,500 will be used to purchase the electric plant of the Glendora Lt. & Pwr. Co. and $29,500 for extending the lighting system throughout the city.

LOS ANGELES, CAL.—The Board of Public Works has approved the plans of City Electrician R. H. Manahan for the installation of an ornamental street-lighting system on San Pedro Street, from Aliso to Jefferson Street, a distance of about 3 miles.

LOS ANGELES, CAL.—Bids will be received by the Board of Education until Dec. 12 for the erection of the main building, science building and power house of the East Los Angeles High School. The power house will be of reinforced concrete, 30 ft. x 40 ft. An appropriation of $150,000 has been made for the work.

QUINCY, CAL.—The Oro El. Corpn., of Oroville, has applied to the Board of Supervisors for a franchise to erect a transmission line for the distribution of electricity in Plumas County.

QUINCY, CAL.—The Indian Valley El. Lt. & Pwr. Co., of Greenville, has purchased a franchise in Plumas County. The company has a power plant in the northern part of the county and will transmit and distribute electricity in Quincy.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co. is planning to extend its transmission lines to Bolinas and Marshalls to connect the Marconi wireless station load.

STOCKTON, CAL.—Negotiations are under way for the consolidation of the San Joaquin Valley El. R. R. Co. and the Modesto & Empire Trac. Co. under the name of the San Joaquin Valley Trac. Co. The new company is to be capitalized at $1,500,000 and proposes to build several extensions in Stanislaus County.

STOCKTON, CAL.—Sealed bids will be received by L. F. Kuhn, clerk of the City Council, until Dec. 17 for sale of franchise as applied for by James W. Goodwin to construct and maintain an underground and overhead electric distributing system in certain portions of the city. Bids will also be received at the same time and place for a similar franchise applied for by John Raggio.

TELLURIDE, COL.—The Utah Pwr. & Lt. Co., which recently took over the property of the Telluride Pwr. Co., proposes to increase the capacity of the present plants and erect new plants, as the company will furnish electrical energy to operate the Denver & Rio Grande Railroad in Utah, which is to be equipped for electrical operation. The Utah Pwr. & Lt. Co. will also furnish power to other Utah railroads. The present output of the Telluride company is about 37,000 hp.

ROCKVILLE, CONN.—The Rockville Gas & El. Co. proposes to erect 3 or 4 miles of pole line for street lighting and commercial lighting distribution system in the town of Ellington. William Lewis is manager of the Rockville Gas & El. Co.

SOUTH NORWALK, CONN.—The managers of the municipal electric-light plant expect to purchase within the next few months some 4/0 weather-proof solid line wire and possibly some larger size; smaller sizes will be purchased from time to time as required. Some ornamental street-lighting fixtures may be purchased. Only general distribution extensions and minor improvements are contemplated by the company within the next few months. A. E. Winchester is general superintendent.

WILLIMANTIC, CONN.—The Willimantic Gas & Elec. Co. expects to extend its distributing system to connect with the State Epileptic Colony at Mansfield. The company is now installing three 50-lamp rectifying outfits, 100 4-lamp magnetite arc lamps and 100 50-watt series incandescent lamps complete. William M. Lewis is manager.

GEORGETOWN, DEL.—The Georgetown Lt., Ht. & Pwr. Co. expects to purchase 50 meters within the next two months. The company contemplates adding another boiler, engine and generator to its plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 17, for furnishing at the navy yards and naval stations supplies as follows: Washington, D. C., Schedule 5012—60 trolley blocks; Schedule 5011—16 trolley frogs, insulators, etc., 2150 lb. copper trolley wire, 188 lb. rubber-covered copper wire, 90 chestnut telephone poles and 8100 ft. galvanized steel strands. Brooklyn, N. Y., Schedule 5015—12 connection boxes; Schedule 5009—railroad crossings. Norfolk, Va., Schedule 5013—10,000 lb. granular sodium carbonate; Schedule 5015—200 lb. hydraulic leather, etc. T. J. Cowie is paymaster general, U. S. N.

PENSACOLA, FLA.—The proposition to issue $400,000 in bonds for municipal improvements will be submitted to the voters on Dec. 30. Of the proceeds $100,000 will be used for electric-light plant and $100,000 for connecting railroads.

ADAIRSVILLE, GA.—The Georgia Ry & El. Co., of Atlanta, has been granted a franchise to supply electricity in Adairsville.

ATLANTA, GA.—A power and heating plant will be erected on Edgewood Avenue by Joel Hart to supply power and steam heat to building now under construction.

ALTON, ILL.—The Alton, Granite & St. Louis Trac. Co. has closed a contract to supply electricity to the amount of 4000 hp for the new plant of the Alton Steel Co., which is to be erected here.

ALVIN, ILL.—The contract for furnishing electricity to the village of Alvin has been awarded to R. C. Wilson & Co., of Henning, Ill. Electricity will be transmitted from the power plant at Potomac, Ill., to the substation to be erected here. The street-lighting contract provides for 20 incandescent lamps of 60 cp. It is expected to have the system completed by June 1, 1913.

ASHMORE, ILL.—The Central Illinois Pub. Ser. Co., of Mattoon, has applied to the Village Board for a franchise to operate an electric-lighting system in Ashmore.

BLUFFS, ILL.—Local residents are reported to be interested in a movement to form a new electric-light company.

BRACEVILLE, ILL.—The Village Commission has awarded the Public Ser. Co. of Northern Illinois, of Chicago, a 10-year contract for lighting the streets of the village. At first there will be but six 75-watt lamps used.

HERSCHER, ILL.—The officials of the villages of Cullom, Kempton, Caberry, Buckingham and Herscher have united in a movement to secure electricity for lamps and motors from either Kankakee or Chatsworth.

JOHNSTON CITY, ILL.—The Central Illinois Pub. Ser. Co. of Mattoon, has purchased the property of the Johnston City El., Gas & Wtr. Co.

LEWISTOWN, ILL.—C. W. King and Albert Sandt have formed a partnership and will incorporate under the name of the Lewistown El. Co. A new 41-year franchise has been asked. Improvements, it is understood, will be made to the plant.

MOUNT MORRIS, ILL.—The Illinois Northern Utilities Co., of Chicago, has purchased the electric plant of the Kables Bros. Co., in Mount Morris.

NIANTIC, ILL.—Residents of the village are contemplating the installation of an electric-light plant in Niantic. Electricity for the system may be secured from the Illionis Trac. System.

PEORIA, ILL.—The East Bluff Improvement Association is interested in a movement for the installation of an ornamental street-lighting system on Knoxville Avenue. A. V. Thomas is president.

RANKIN, ILL.—The Village Board has granted the Central Illinois Utilities Co., of Watseka, a franchise to operate an electric-light plant in Rankin for a period of 30 years.

INDIANAPOLIS, IND.—The Indianapolis Lt. & Ht. Co. is preparing plans for an addition to its Mill Street station which will give the company sufficient space to install three 10,000-kw turbine equipments, with the usual boiler and auxiliary apparatus. The foundation for this will be laid this winter. The superstructure will be started early in the spring. The apparatus to be installed will be purchased about June, 1913. A coal storage bin, 100 ft. by 300 ft., 28 ft. deep, in which the company expects to store from 25,000 to 30,000 tons of coal under water, is being completed. Thomas A. Wynne is vice-president.

MADISON, IND.—The Madison Lt. & Ry. Co. on Nov. 1 completed the rebuilding of its plant, replacing the old 133-cycle, single-phase system with a 60-cycle, three-phase system. M. F. Tennis is treasurer.

AMES, IA.—The city of Ames is planning to build a new power house or rebuild the present one and to purchase two boilers and engine direct-connected to generator and coal and ash handling machinery during the next 12 months. Charles E. Warsaw is manager.

CLEARFIELD, IA.—John Anderson is interested in the company which proposes to install an electric-light system here. Gas engines will be used.

CLINTON, IA.—The Clinton Gas & El. Co. expects to erect transmission lines to Fulton, Ill., a distance of 5 miles; also to purchase four water-tube boilers, two 1000-kw turbines and auxiliary equipment, consisting of stokers, coal and ash handling system, exciters, pumps, condensers, oiling system, etc., switchboard, instruments, switches, protective devices and material for distributing system, consisting of transformers, poles, transmission towers, lightning arresters, insulators, distribution cable and wire, meters, etc., and equipment for lighting systems within the next six months. Thomas Crawford is general manager.

DUNCOMBE, IA.—G. J. Long is said to be interested in a company which is asking for a franchise to install and maintain an electric light and power plant in Duncombe.

FORT MADISON, IA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 17 for construction of United States post office building, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches in Fort Madison. Drawings and specifications may be obtained from the above office or from the custodian of site at Fort Madison. Oscar Wenderoth is supervising architect.

LE MARS, IA.—D. H. Maury and J. W. Alvord, of Chicago, Ill., have been engaged to make an appraisal of the property of the Le Mars Wtr. & Lt. Co. with a view of the plant being taken over by the city. An election will soon be held to vote upon the proposition.

LEON, IA.—The Leon El. Co. expects to purchase within the next 12 months one 200-kw, 2300-volt, three-phase, 60-cycle alternator, one 300-hp engine and probably a 200-hp boiler, one generator panel and incandescent street-lighting apparatus. The company is constructing transmission lines from Leon to Humeston, Garden Grove, Leroy Walden and Van Wert. G. A. Havens is vice-president and secretary.

MILTON, IA.—At an election held recently the proposition to grant a 25-year franchise to L. R. Sherrill, of Burlington, Ia., to install and maintain an electric-light and power plant here was carried.

PRESTON, IA.—At an election held Nov. 22 the proposition to issue $8,000 in bonds for the installation of an electric-light plant was carried. G. H. Lucas is city clerk.

WALKER, IA.—Application will be made by W. R. Furman for a franchise to erect a transmission line from Troy Mills to Walker.

ABILENE, KAN.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 7 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduit and wiring, interior lighting fixtures and approaches, of the United States post office at Abilene, Kan. Drawings and specifications may be obtained at the above office or from the custodian of site at Abilene. Oscar Wenderoth is supervising architect.

HUTCHINSON, KAN.—The United Water, Gas & El. Co. is installing one 2500-kva, two-phase, 60-cycle, 2200-volt Allis-Chalmers turbo-generator, with necessary additional switchboards, instruments, auxiliaries, etc., including turbine-driven exciter unit and turbine-driven condensing apparatus made by the Westinghouse Machine Co. The company also is erecting a 6600-volt transmission line, using in connection therewith two 400-kw, two 200-kw, two 150-kw and two 75-kw, 6600-2200-220-volt transformers. J. F. Springfield is general manager.

SABETHA, KAN.—Steps have been taken by the Commercial Club of Sabetha to secure estimates of the cost of the installation of an ornamental street-lighting system here.

SALINA, KAN.—The Salina Lt., Pwr. & Gas Co. is installing one 500-kw, three-phase, 2200-volt, 60-cycle Westinghouse-Parsons turbo-generator, with necessary condensing and switchboard apparatus. J. F. Springfield, of Hutchinson, is general manager and W. E. McFadden local manager.

CUMBERLAND, MD.—The Edison El. Illg. Co., of Cumberland, has applied to the Public Service Commission for permission to issue $50,000 in capital stock. The proceeds, it is stated, will be used for improvements and betterments to its system.

HAGERSTOWN, MD.—The Board of Trade of Hagerstown has appointed a committee to promote the installation of an ornamental street-lighting system in the business district. A. K. Coffman is a member of the committee.

AMHERST, MASS.—The Amherst Gas Co. expects to erect within the next six months a transformer and switching substation. Contracts for equipment have already been awarded. The company is completing a distributing system for street-lighting and commercial service in the town of Hadley, which will be placed in service Dec. 15.

BOSTON, MASS.—Sealed bids will be received by Manus J. Fish, superintendent of public buildings of the city of Boston, until Dec. 23 for furnishing and installing the electric generating plant for an office building, the annex to the city hall, located on Court Street, Boston, and other work incidental thereto. Drawings and specifications may be secured at the office of Edward T. P. Graham, architect, 20 Beacon Street, Boston, for which a deposit of $5 will be required.

BOSTON, MASS.—Sealed proposals will be received by Manus J. Fish, superintendent of public buildings of the city of Boston, until Dec. 23 for furnishing and installing electric wiring and lighting fixtures in an office building, the annex to the city hall, located on Court Street, Boston, and other work incidental thereto. Plans and specifications may be obtained at the office of Edward T. P. Graham, architect, 20 Beacon Street, Boston. A deposit of $25 will be required for each complete set of drawings and specifications or $5 for each set of fixture drawings and specifications, which will be refunded upon return of same.

FALL RIVER, MASS.—Extensive improvements involving an expenditure of over $200,000 have been authorized by the directors of the Fall River El. Lt. Co. These improvements will be made within a year and will include the installation of a 4000-kw Curtis turbine engine and complete system of automatic stokers and automatic coal conveyors. The substation on Hartwell Street will be enlarged and a new switchboard installed.

LAWRENCE, MASS.—The Lawrence Gas Co. is installing a 5000-kva Curtis horizontal turbine, furnished by the General Electric Co., with necessary condensing outfit supplied by Henry R. Worthington Co., and switchboard equipment supplied by the General Electric Co. The installation of this machine has involved the erection of a new building. The work is nearly completed. C. J. R. Humphreys is vice-president and agent.

CHEBOYGAN, MICH.—The Cheboygan El. Lt. & Pwr. Co. has applied for an extension of its franchises for operating within the city limits. The question will be submitted to the voters at a special election to be held on Jan. 1. The company also contemplates the construction of an electric railway between Cheboygan and Petoskey.

DETROIT, MICH.—The Hayes Mfg. Co. is equipping its plant for electrical operation. Electricity will be secured from the Detroit Edison Illg. Co.

DETROIT, MICH.—The Peninsular Engraving Co. will install 100 direct-current motors and one freight elevator in its building now in course of erection.

DETROIT, MICH.—The Ford Motor Co., of Detroit, is installing a 2500-kw, 250-volt direct-current generator to be driven by a special engine designed by Mr. Gray, chief engineer of the Ford Motor Co.

DETROIT, MICH.—The Michigan Lubricator Co. is equipping its plant for electrical operation. The equipment includes 17 motors, three-phase, 400-hp, and transformers. Electricity for operating the plant will be supplied by the Detroit Edison Illg. Co. The cost of the installation is estimated at about $8,000.

DETROIT, MICH.—A power plant is being installed in the Dime Bank Building to supply electricity for lamps and motors. The equipment will include five 200-kw, 250-125-volt, three-wire direct-current Crocker-Wheeler generators with ball engine. A tunnel will connect the Dime Bank with the Ford Building and electricity will be supplied to the tenants of the Ford Building for lamps. J. F. Bowles will be chief engineer of the plant.

GRAND RAPIDS, MICH.—A campaign has been started by the business men on South Division Street to extend the boulevard street-lighting system on that avenue as far as possible.

HOWELL, MICH.—Plans are being considered for the installation of new machinery in the municipal electric-light plant next year, to cost about $12,000.

ITHACA, MICH.—A 150-hp Murray Iron Works boiler has been installed at the municipal electric-light plant. H. E. Churchill is superintendent.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co. (St. Clair Division) will install 18 100-watt tungsten lamps on Cass Avenue as an experiment, and if satisfactory a new contract between the city and the company will be made and the new lamps will be installed throughout the entire city.

REED CITY, MICH.—The Osceola Lt. & Pwr. Co., Reed City, expects to install an auxiliary steam plant next spring. The equipment will include one 100-kw, three-phase alternator. B. J. Stall is secretary and manager.

RIVER ROUGE, MICH.—The City Council has engaged Patrick Keating, of Detroit, engineer, to supervise improvements that are to be made to the municipal electric-light plant. The cost of the work is estimated at about $15,000, and it will include changes in overhead construction and the installation of additional machinery.

BRECKENRIDGE, MINN.—The Water and Light Commission is considering the question of installing cluster lamps along Minnesota Avenue from Second to Sixth Street.

PIPESTONE, MINN.—All bids submitted for the proposed electric-lighting system at the Pipestone Indian School, Minnesota (which were opened by the Commissioner of Indian Affairs, Washington, D. C., Nov. 20) have been rejected. Bidders will be asked to submit proposals for a modified system.

BILOXI, MISS.—The water-works committee of the City Council has adopted the plans of Superintendent E. L. Castenera for the installation of electrically operated pumps in the new pumping station. The plans provide for three electrically operated pumps, each with a capacity of 750 gal. per minute.

HELENA, MONT.—The State Prison Board contemplates asking for an appropriation for the installation of an electric power plant, to cost

about $80,000, to serve the insane asylum, prison and tuberculosis hospital. It is proposed to locate the plant between Warm Springs and Deer Lodge.

CLARKS, NEB.—The contract for the construction of the proposed municipal electric-light plant has been awarded to the Alamo Engine & Sup. Co., of Omaha, Neb., W. E. Donner, of Grand Island, Neb., is engineer.

CLAREMONT, N. H.—The Claremont Pwr. Co. has installed a 17-panel switchboard, replacing the one destroyed by fire on Aug. 14, 1912. L. N. Wheelock is secretary and manager.

MONTAGUE, N. J.—The Deleware Hydro-Electric Co. and associated interests of Camden, N. J., have acquired water-front property on the Delaware River in Montague Township, to be used in connection with the proposed plans to construct a dam across the Delaware River and construction of a hydroelectric power plant. George H. B. Martin, of Camden, is interested in the project. Montague has not a post office.

NEWARK, N. J.—Property owners on Springfield Avenue between High and Bergen Avenues have requested the Public Ser. El. Co. to submit estimates of cost of installing flaming-arc lamps on that street similar to those now in use in the center of the city.

PENNS GROVE, N. J.—The Public Utility Commissioners of New Jersey have approved the franchise passed by the Borough Council granting the Penns Grove El. Lt., Ht. & Pwr. Co. permission to install and operate an electric-light plant here. The commission also gave its approval of the proposed issue of capital stock and bonds by the company.

GALLUP, N. M.—Application has been made to the Town Trustees by a company composed of local business men for a franchise to build a new electric-light plant here.

ALBANY, N. Y.—The Public Service Commission has granted the Bell and Independent Tel. Cos. in the counties of Clinton, Essex, Franklin and St. Lawrence, with minor extensions into Warren and Washington Counties, permission to consolidate under the title of the Mountain Home Tel. Co. The commission has authorized the Mountain company to increase its capital stock from $150,000 to $1,000,000 and to execute a mortgage to secure a maximum issue of $2,000,000 in bonds. The Mountain Home Tel. Co. will soon issue $633,000 in capital stock and $1,004,200 for the purchase of the property and business of the Adirondack Home Tel. Co. and the New York Tel. Co. in the territory affected and for refunding of present outstanding bonds.

BROOKLYN, N. Y.—Sealed bids will be received by Henry S. Thompson, commissioner, Department of Water Supply, Gas & Electricity, Room 1904, 13 to 21 Park Row, borough of Manhattan, until Dec. 10, for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and public places, in the borough of Brooklyn, from Jan. 1, 1913, to Dec. 31, 1913, both inclusive. Blank forms may be obtained at the office of the department Room 2339, Park Row Building.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Pwr. Co. contemplates the purchase of supplemental auxiliary equipment for a 10,000-kw steam-turbine plant, particularly stokers and a coal and ash handling system, within the next four months. F. B. H. Paine is general manager.

DUNDEE, N. Y.—E. L. Bailey, owner of the local electric-light plant, contemplates within the next six months the erection of a pumping station for the village water-works system; also the erection of 10¼ miles of electric transmission line to two other smaller towns. He also expects to purchase a triplex pump, 6 in. by 8 in. or 8 in. by 10 in., for the water-works system; line protector devices, transformers (step-up), fuse boxes, line material, lightning arresters, bare copper line wire, insulators, arms, etc., and transformers for lighting system within the next six months.

MECHANICSVILLE, N. Y.—The Mechanicsville El. Lt. & Gas Co. is changing its system from 133 cycles, single-phase, to 60 cycles, three-phase, and has purchased generators, switchboards, etc. Edwin Farrow is president.

NEW YORK, N. Y.—A committee has been appointed by the Broadway Association to secure, if possible, better lighting facilities for Broadway. It is proposed to adopt a plan similar to that adopted by the Fifth Avenue business men.

NEW YORK, N. Y.—Plans will be prepared by McKim, Mead & White, architects, 160 Fifth Avenue, New York, for the erection of a fireproof power house at First Avenue and Twenty-ninth Street for the Bellevue and Allied Hospitals, foot of East Twenty-sixth Street. The proposed plant will supply power for the entire hospital group situated on this block. Dr. John W. Brannan is president.

NEW YORK, N. Y.—Sealed bids will be received by R. Waldo, police commissioner, Police Department of the city of New York, at the bookkeeper's office, headquarters of the Police Department, 240 Centre Street, New York, until Dec. 10, for furnishing all labor and furnishing and erecting all materials required for electrical conductors and placing electrical conductors underground. Copies of specifications and blank form for bids may be obtained at the office of the commissioner, and further information may be obtained at the office of the superintendent of telegraph, 240 Centre Street, borough of Manhattan.

NEW YORK, N. Y.—Sealed bids will be received by Henry S. Thompson, commissioner, Department of Water Supply, Gas and Electricity, Room 1904, 13 to 21 Park Row, borough of Manhattan, until Dec. 10 for furnishing and maintaining electric lamps for lighting streets, avenues, public buildings, parks and other public places from Jan. 1, 1913, to Dec. 31, 1913, both inclusive, as follows: No. 1—borough of Manhattan; No. 2—borough of the Bronx; No. 3—boroughs of Manhattan and the Bronx; No. 4—borough of Queens, and No. 5—borough of Richmond. Blank forms may be obtained at the office of the department, Room 2339, Park Row Building.

PHILMONT, N. Y.—At a special election held Nov. 26 the proposition to expend $5,000 for the purchase of material for a distributing system for lighting the village, including poles, wires, lamps, other fixtures and line equipment, was carried.

POTSDAM, N. Y.—The Northern Pwr. Co. has petitioned the Public Service Commission for permission to erect a transmission line in the village of Atnwerp, the town of Antwerp and the town of Rossie.

SODUS, N. Y.—The Wayne Pwr. Co. expects to erect a transmission line from Atlanta to Naples, N. Y., and a distributing system in the village of Naples, for which franchises were granted Nov. 28. On the main line electricity will be transmitted at 11,000 volts, three-phase. Equipment will be purchased for above distributing system and street-lighting system for Naples, consisting of probably 75 40-watt tungsten series street lamps, including constant-current transformer, regulator, etc., within the next 12 months. The system covers Avoca, Wallace, Cohocton, Atlanta, North Cohocton and Naples. The company has street-lighting contracts in Cohocton, Atlanta, Avoca and Naples for a period of five years. Street lamps have been turned on in Cohocton and the service will soon be ready in Atlanta and North Cohocton and later in Avoca. The service will not be extended to Naples until next summer. G. R. Mills is president.

SOUTHAMPTON, N. Y.—The Suffolk Lt., Ht. & Pwr. Co. expects to purchase a new boiler and engine and two new tub transformers during the next four months. W. M. Hambright is general manager. W. M. Sheehan & Co., 114 Liberty Street, New York, N. Y., are engineers.

STARKEY, N. Y.—Edward L. Bailey, owner of the Dundee electric-light plant, has applied to the Town Board for a franchise to extend the local system to several points throughout the town, to include Lakemont, Starkey and Glenora.

SYRACUSE, N. Y.—The Public Service Commission has authorized the Syracuse Ltg. Co. to issue $197,000 in bonds, to be sold at not less than 99, the proceeds to be used for various extensions and improvements to its gas and electric service in Syracuse.

WAYLAND, N. Y.—The Wayland Steuben Pwr. Co. expects to purchase machinery and equipment for an electric power plant and distributing system within the next two months. John Kimmel, of Wayland, is interested in the company.

WEEDSPORT, N. Y.—At a special election held Nov. 26 the taxpayers voted in favor of the proposition to issue $15,000 in bonds for the installation of a municipal electric-light plant. Niagara power will probably be used to operate the system.

WEST SAND LAKE, N. Y.—The Public Service Commission has authorized the Wynantskill Hydro-Electric Co. to execute a mortgage to secure an issue of $50,000 in bonds. The company is authorized to issue at this time $4,500 in capital stock and $7,500 in bonds, the proceeds to be used for payments due for additions and extensions to its plant and for proposed new construction. The company operates in West Sand Lake, Averill Park and surrounding country.

MOUNT OLIVE, N. C.—Extensions are contemplated to the municipal electric-light plant within the next six or eight months, which will include the purchase of one 100-kva, 2300-volt, three-phase generator, direct-connected, and probably 5 or 6 miles of wire next year. S. L. Oliver is manager.

NEW ROCKFORD, N. D.—F. E. Corson and associates, of Fargo, have purchased the Wilson electric plant franchise. As it was granted before the city was incorporated the new owners are asking a new franchise.

BRYAN, OHIO.—The City Council has appropriated $5,000 for the installation of cluster lamps in the business district. Improvements are being made to the municipal electric plant.

CINCINNATI, OHIO.—Plans have been completed for the erection of a new 10-story office and exchange building by the Cincinnati & Suburban Bell Tel. Co. at Fourth Avenue and Hammond Street, Cincinnati.

CLYDE, OHIO.—The contract for rebuilding the municipal electric-light plant and water-works system has been awarded to the Joseph L. Skeldon Engineering Co., Spitzer Building, Toledo, Ohio. The plant is to be reconstructed and all new machinery is to be installed. The cost of the work is estimated at $35,000.

DEFIANCE, OHIO.—The City Council has granted the Auglaize Pwr. Co., of Defiance, a 25-year franchise to erect and maintain transmission lines through this city.

DEFIANCE, OHIO.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 14, for construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of United States post office building at Defiance, Ohio. Drawings and specifications may be secured at the above office or from the custodian of site at Defiance, Ohio. Oscar Wenderoth is supervising architect.

EAST LIVERPOOL, OHIO.—The Board of Control has been authorized by the City Council to secure the services of an electrical engineer to prepare an estimate of the cost of installing a municipal electric-light plant.

ELYRIA, OHIO.—The Cleveland, Southwestern & Columbus Ry. Co., of Cleveland, has applied to the City Council for a franchise to supply electricity for lamps and motors in Elyria.

FOREST, OHIO.—As a result of the decision of the Circuit Court, recently handed down, the Hardin-Wyandotte Ltg. Co., of Kenton, is restrained from furnishing electricity for lighting the villages of Forest and Dunkirk. Business men of Forest have taken steps to form a local company to furnish electrical energy for lamps and motors here.

LEETONIA, OHIO.—The Leetonia El. Co. expects to purchase material for distributing system amounting to about $1,000 and electrical appliances and supplies costing about $3,000 within the next 12 months. E. H. Geiselman is general manager.

NEW KNOXVILLE, OHIO.—The New Knoxville El. Co. is installing an electric-light and power system here. Electricity for operating the system will be purchased from the Western Ohio El. Ry. Co. Electrical energy will be secured from the station 5 miles north of here, which will be transmitted at 6600 volts, three-phase, 25 cycles. The New Knoxville company proposes to supply electricity for lighting the streets of the village, residences, stores, etc., and also for power purposes. Practically all material has been purchased. A. H. Steinecker is secretary.

WASHINGTON C. H., OHIO.—The Washington Gas & El. Co. has received authority from the Public Service Commission to issue $100,000 in bonds, the proceeds to be used to retire outstanding bonds and to make extensions. The company has also been authorized to issue $50,000 in capital stock for the purpose of making other improvements.

PONCA CITY, OKLA.—Sealed proposals will be received by W. M. Rawlings, city clerk, until Dec. 17, for furnishing material and constructing improvements to the water-works system in Ponca City. Separate bids will be received as follows: (1) For transmission line, power house and erecting machinery furnished under separate contract with necessary connections complete; (2) for furnishing horizontal turbine pumps of 750, 450 and 350 gal. per minute, complete with motors and starters, in accordance with plans and specifications on file in the office of the city clerk, Ponca City, and at the office of Burns & McDonnell, Scarrett Building, Kansas City, Mo., consulting engineers. Copies of plans may be secured on application to the consulting engineers upon payment of $3 to cover cost of prints. Fred D. Sparks is Mayor.

ASTORIA, ORE.—William Hobson, representative of the Hammond Lumber Co., of Astoria, has asked for permission to construct a 10,000-hp power plant on the north fork of the Satiam and Breitenbush Rivers.

CLINE FALLS, ORE.—George Jacobs has applied to the County Commissioners for permission to erect electric transmission lines and private telephone lines in this vicinity. An electric generating plant will be installed at Cline Falls.

DAYTON, ORE.—The Pati Tel. Co., recently organized, will soon begin work on the erection of about 50 miles of line. Thomas Reed is president of the company.

GRANT'S PASS, ORE.—The California-Oregon Pwr. Co. has applied to the City Council for a 40-year franchise for its power and light system, in return for which the company offers to pay the city 2 per cent of the gross revenue in the city and make certain concessions in the way of street lamps for a period of 10 years.

OREGON CITY, ORE.—Application has been filed with the state engineer by B. T. McBain, of Oregon City, asking for an appropriation of sufficient water from Clackamas River to develop 11,364 hp. The plans provide for the construction of a dam 30 ft. high and a canal 5 miles long, at a total cost of about $1,000,000.

REDMOND, ORE.—The Prineville Lt. & Wtr. Co., of Prineville, has secured the contract for furnishing electric lamps in Redmond. The company has acquired a power site on Cliff Falls and will install a hydroelectric power plant there.

SILVERTON, ORE.—The health, fire and water committee of the City Council is considering the installation of a cluster-lamp lighting system in the business district of the city.

HARRISBURG, PA.—Extensive improvements are being made by the Harrisburg Lt. & Pwr. Co., including the installation of a 2500-kva, 2300-volt, 60-cycle alternating-current Westinghouse horizontal-type turbine unit, with necessary switchboards for same; four 1250-kw, 2300-6900-volt transformers, McClave-Brooks furnaces, grates, blowers, complete under-pressure boilers and complete coal-conveying system. The Ninth Street station is being rehabilitated as a main distributing station and a complete switchboard is being installed to take care of the distribution of both alternating current and direct current for commercial, residential and outlying districts of the city of Harrisburg and adjacent territory. The old two-phase distribution system of the former Paxtang company is being changed over to a three-phase alternating-current system, which will be practically completed by Jan. 1, 1913. The company is installing fiber conduits in all parts of the commercial district. This underground system will include the erection of three complete centers of distribution substations, each of which will contain four 200-kw, 6900-115-230-volt transformers, switchboards, regulators, etc., complete. George B. Tripp is vice-president and general manager.

HONESDALE, PA.—The Honesdale Consol. Lt., Ht. & Pwr. Co. expects to purchase within the next three months one 150-kw, 2300-volt, 60-cycle, two-phase engine-type generator and one generator and one feeder panel for the above machine. F. H. Eisele is superintendent.

IRWIN, PA.—The Council has authorized the West Penn El. Co. to replace the present arc-lighting system with tungsten lamps. Under the new system 85 tungsten lamps will be used.

PITTSBURGH, PA.—Notice has been filed with the State Department at Harrisburg that the Monongahela Lt. Co. and the Oakman & Verona Lt., Ht. & Pwr. Co. have been consolidated under the name of the Duquesne Lt. Co., of Pittsburgh, with a capital stock of $541,000. N. B. Starring, of New York, N. Y., is president of the new company.

STOYESTOWN, PA.—The Stoyestown Lt. & Pwr. Co. will soon begin work on the erection of a transmission line from Stoyestown to Ferrellton. The company will supply electrical service to residents along the line as well as in Ferrellton.

TITUSVILLE, PA.—The Titusville Lt. & Pwr. Co. has purchased and will install about Jan. 1 one 300-hp, four-cylinder, 257 r.p.m. vertical gas engine, made by the Titusville Iron Co., of Titusville, direct-connected to a 200-kva, three-phase, 2300-volt, 60-cycle General Electric alternator and one motor-generator set, consisting of one 10-kw, 125-volt exciter direct-connected to a 15-hp, three-phase, 220-volt motor, and additions to switchboard, consisting of one Blue Vermont generator panel, one exciter panel and one feeder circuit panel. Eugene F. McCabe is vice-president.

TYRONE, PA.—The Home El. Lt. & Steam Htg. Co. has just finished the installation of a 414-hp Stirling boiler, complete with Foster superheater and 50-lamp rectifier set for 4-amp General Electric magnetite lamps, and is now installing a 35-kw motor-driven exciter and motor-driven circulating pump for condensing water and a steel-tower railway crossing over the Pennsylvania Railroad at Tyrone for transmission line to Bellwood. P. M. Arndt is superintendent.

JAMESTOWN, R. I.—The Bay State Street R. R. Co., which furnishes electricity in Newport, has applied to the Town Council for permission to exercise the electric-light franchise recently purchased from the Jamestown Lt. & Wtr. Co. The latter company never availed itself of the lighting privilege.

WOONSOCKET, R. I.—The Blackstone Valley Gas & El. Co. is installing a 1250-kw Allis-Chalmers frequency-changer set at its No. 1 steam station on Front Street, Woonsocket. This set is to be utilized as a connecting link between its 25-cycle, 13,200-volt railway distributing system and its 60-cycle, 2300-volt commercial lighting and power system. In addition to the frequency-changer set and necessary switchboard equipment an extension will be made to the building. The cost of the entire work is estimated at about $30,000. The work is being done by the Stone & Webster Engineering Corpn., of Boston, Mass. A. F. Townsend is manager.

FLANDREAU, S. D.—The Flandreau Lt. & Pwr. Co. contemplates the purchase of one 75-kva alternating-current, engine-type generator and one 125-hp gas producer and engine within the next six months. A. H. Savage, 614 Germania Life Bldg., St. Paul, Minn., is president of the company.

DECHERD, TENN.—The Stone Pwr. Co. and W. G. Cummins have been granted a franchise to install an electric light and power system in Decherd. They are now extending a transmission line from Winchester along the boulevard, which will be illuminated with "Mazda" lamps erected on every other pole.

EAST CHATTANOOGA, TENN.—The East Chattanooga Business League is negotiating with the Chattanooga Ry. & Lt. Co. for the installation of an electric-light system here. The company, it is said, proposes to install a transformer station between Glass and Stewart Streets and furnish electricity for lamps on Chamberlain Avenue and Glass Street first and extend the system as far as Boyce, back to the city and taking in Avondale. J. L. Wilhoite, of Chattanooga, is contract agent of the company.

MEMPHIS, TENN.—Sealed proposals will be received at the office of the Mississippi River Commission, First and Second Districts, United States Engineer Office, Room 20, Custom Office, Memphis, Tenn., until Dec. 23 for furnishing turbines, pumping sets, hot well, feed-water heater and electric-light plant for hydraulic grader No. 1205. Further information may be obtained on application to E. M. Markham, major engineers.

ROGERSVILLE, TENN.—The Rogersville El. Co. expects to erect two transmission lines, one 12 miles and the other 5 miles long, within the next 12 months, and will probably purchase one 56-in. vertical waterwheel within six months; it also expects to purchase within the next few months a series incandescent street-lighting system. Vance G. Hale is manager.

ABILENE, TEX.—The gas, electric light and power, water and ice properties in Abilene will be taken over at once by the American Pub. Ser. Co., which will be a holding company for the gas and electric properties in Texas, Louisiana and Oklahoma that are controlled by N. W. Halsey & Co., of New York, N. Y., and associates. The capital stock of the company was recently increased to $25,000,000. The company has an authorized issue of $25,000,000 in bonds, of which $2,000,000 will be issued at once.

BALLINGER, TEX.—Preliminary surveys have been finished for the proposed irrigation district that is to be created near here. The plans call for the construction of a dam across the Colorado River, forming a storage reservoir sufficient to irrigate 129,000 acres of land.

CLARKSVILLE, TEX.—Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 26 for construction, including plumbing, gas piping, heating appar-

atus, electric conduits and wiring and interior lighting fixtures, of the United States post office building at Clarksville, Tex. Copies of drawings and specifications may be had at the above office or from the custodian of site at Clarksville. Oscar Wenderoth is supervising architect.

MANVEL, TEX.—The Suburban Gardens Tel. Co., recently organized, will erect 75 miles of telephone line, bids for which will be received about June 1, 1913. T. E. Scott is manager.

PARIS, TEX.—The Stone & Webster Engineering Corpn., of Boston, Mass., through representatives of the Texas Trac. Co., of Forth Worth, is investigating the proposition of building an interurban electric railway between Paris and Sherman, a distance of about 60 miles.

OGDEN, UTAH.—To provide for the increased flow of water resulting from the improvement of the canyon reservoir and the enlargement of the Twelfth Street power plant the Utah Lt. & Ry. Co. is planning to build a concrete tailrace and additional reservoir between the power station and the Ogden River, to cost about $30,000.

SALT LAKE CITY, UTAH.—Eastern capitalists, represented by M. B. Hereley, of Chicago, are negotiating for the purchase of the property of the Salt Lake & Ogden El. Ry. Co. The new owners are considering the extension of the railway south from Salt Lake City and north from Ogden.

MONTPELIER, VT.—The Consol. Ltg. Co. is building an addition to its boiler room, 55 ft. by 35 ft., and is installing two 625-hp boilers and one 2500-kw steam turbine. The company expects to install within the next two months one 50-kw exciter, condenser for 2500-kw turbine, coal-handling apparatus and transformers stepping up current from 2300 volts to 13,200-22,000-33,000 volts. It also expects to change within the next 12 months 30 miles of high-tension lines from 13,200 volts to 22,000 or 33,000 volts. The company within the next six months expects to purchase one 300-kw transformer, 11,000-22,000-33,000 to 2300 volts. All purchases will be made from the Boston (Mass.) office of C. H. Tenney & Co., which recently took over this company and also the Vermont Pwr. & Ltg. Co. H. D. Larrabee is manager.

MANASSAS, VA.—The Town Council has engaged Harry Stevens, consulting engineer, Union Trust Building, Washington, D. C., to make surveys and prepare plans and estimates for electric light and power plants, water and sewer systems.

PURCELLVILLE, VA.—Bonds to the amount of $5,000 have been voted, the proceeds to be used for street lighting and other improvements.

CAMAS, WASH.—The Northwestern El. Co. is planning to install a complete lighting and power system in Camas.

CONCRETE, WASH.—The Stone & Webster Engineering Corpn., of Boston, Mass., has acquired water rights of the Skagit Pwr. Co. at Cedar Bar, and will build a large dam there to develop the water-power.

KELSO, WASH.—The Washington-Oregon Corpn., of Vancouver, will soon begin work on the erection of an auxiliary power plant near Kelso.

MONROE, WASH.—Sealed proposals will be received by the board of managers of the Washington State Reformatory until Dec. 12 for the following apparatus for reformatory: Engine, generator, switchboards, etc. Plans and specifications may be seen at the office of the superintendent and at the office of Saunders & Lawton, architects, Alaska Bldg., Seattle, Wash. C. B. Roe is superintendent.

PORT ANGELES, WASH.—The Olympic Pwr. Co. is planning to rebuild the dam on the Elwha River washed out by flood at a cost of about $175,000. Thomas T. Aldwell is vice-president and general manager.

TACOMA, WASH.—The Pacific Tel. & Teleg. Co. contemplates the erection of a three-story and basement substation in South Tacoma, to cost about $100,000.

SUPERIOR, WIS.—The Superior Wtr., Lt. & Pwr. Co. has recently installed a 1000-kw motor generator set and has under construction a 100-kw booster set. William H. Winslow is vice-president and general manager.

CALGARY, ALTA., CAN.—Extensive additions are being made to the municipal arc-lighting system. It has not been definitely decided yet as to whether ornamental lamp standards with incandescent lamps will be used on the main streets. A number are now being installed for inspection and tests. R. A. Brown is superintendent.

ALBERNI, B. C., CAN.—A by-law has been passed authorizing an expenditure of $30,000 for installation of an electric-light system.

ESQUIMALT, B. C., CAN.—Negotiations are under way between the Council and the British Columbia El. Ry. Co. looking to the installation of an electric-lighting system, consisting of 300 80-watt tungsten lamps. C. S. Manchester, of Vancouver, is consulting engineer.

MIRROR LAKE, B. C., CAN.—Sufficient capital has been subscribed by residents of this municipality to cover the cost of the installation of an electric-light plant. A. Link is one of the promoters.

NELSON, B. C., CAN.—Work has begun on the installation of piping which will contain the cables in connection with the new three-lamp tungsten cluster lighting system here. It is proposed to install ornamental lamps on all the principal streets of the city.

NEW WESTMINSTER, B. C., CAN.—The New Westminster Pwr. Co., Ltd., contemplates the erection of a power plant to supply electricity in the Fraser Valley District. The company will apply for water-power rights on Brandt Creek, Indian River, Young Lake and Norton Lake. It is proposed to erect a 500-acre-ft. reservoir at Young Lake, one with a capacity of 10,000 acre-ft. at Norton Lake, a third on Indian River to hold 2500 acre-ft., and a fourth to handle 10 cu. ft. per second flowing from Brandt Creek.

VICTORIA, B. C., CAN.—The Gordon River Pwr. Co., of Victoria, has applied to the government of British Columbia for a license to divert and use 1200 cu. ft. of water per second from the Gordon River. The water will be diverted at a point about 40 miles northwest of Victoria and will be used for power purposes.

WADENA, MAN., CAN.—A by-law has been passed authorizing the expenditure of $20,000 for the installation of an electric-light plant. The British & American Engineering Co., of Winnipeg, Man., has the contract, which is to be completed by Jan. 5, 1913.

WINNIPEG, MAN., CAN.—The municipal fire, water and light committee has authorized the extension of the Main Street cluster-lamp lighting system to the northern limits of the city.

SYDNEY, N. S., CAN.—The Cape Breton El. Co., of Sydney, recently submitted a proposition to the Town Council for street lighting as follows: For arc lamps, $86.07 each per year; 200-cp incandescent lamps, $62.62 per lamp per year, and 40-cp incandescent lamps, $19.09 each per year. The Council has decided to accept the 200-cp lamps.

BRECHIN, ONT., CAN.—At an election held Nov. 22 the by-law providing for securing hydroelectric power from the Ontario Hydro-Electric Power Commission was carried.

CHESTERVILLE, ONT., CAN.—At an election held recently the by-law providing for the installation of a hydroelectric power system was carried.

DRYDEN, ONT., CAN.—The power house and sluicegates of the Dryden Timber Pulp & Pwr. Co., Dryden, were destroyed by fire on Nov. 28, causing a loss of about $100,000. The plant was under construction and nearly completed. Harris & Harris, of Toronto, are contractors.

KINGSTON, ONT., CAN.—J. M. Campbell, of the Kingston Milling Co., has submitted a proposition to the utilities committee of the Council offering to furnish the city with power to the amount of 500 hp at ¾ cent per kw-hr. The power would be generated at the Kingston Mills, about 5 miles from the city.

WALKERVILLE, ONT., CAN.—The Ford Automobile Co., Canadian branch, is installing two 500-kva, three-phase, 60-cycle, 480-volt Crocker-Wheeler alternators. The plant was designed by Mr. Gray, chief engineer of the Ford Motor Co., of Detroit, Mich.

WINDSOR, ONT., CAN.—Plans are being considered for the installation of new equipment for the municipal electric-light plant, involving an expenditure of about $20,000.

WOODVILLE, ONT., CAN.—At an election held Nov. 21 the ratepayers voted in favor of the by-law to purchase hydroelectric power from the Ontario Hydro-Electric Commission.

GRAND-MERE, QUE., CAN.—Work will soon begin on construction of the power dam in connection with the new power development at the paper and pulp works of Laurentide, Ltd., of Grand-Mère. The plans provide for the development of an additional 25,000 hp from the Grand-Mère Falls, which it is proposed to sell.

REGINA, SASK., CAN.—Sealed tenders will be received by the City Commissioners of Regina, Sask., until Dec. 14 for construction of power house, laundry and refrigerating plant at Regina General Hospital. Full particulars may be secured upon application to Wenger & Cockburn, Room 208, Aldon Block, Twelfth Avenue, Regina. Plans may be seen at the office of the Builders' Exchange, Winnipeg, Man., and at the office of the consulting engineers, Regina.

SASKATOON, SASK., CAN.—A. G. Sangster, superintendent of the municipal electric-light plant, has submitted an estimate to the City Council for material required for extensions for the year 1913 as follows: 2000 meters, forty 30-kw, fifty 20-kw, fifty 15-kw, and ten 50-kw transformers; 225,000 lb. wire; 1200 35-ft. poles, 600 40-ft. poles, 100 45-ft. poles, 100 50-ft. poles; cross-arms, pins, insulators, hardware; one motor-service wagon. The total cost of the above is estimated at $150,000.

SUTHERLAND, SASK., CAN.—The town of Sutherland is considering the installation of a municipal electric light and power plant.

New Industrial Companies

THE DIAMOND GAS & ELECTRIC ENGINEERING COMPANY, of Anderson, Ind., has been incorporated by I. N. Stillwell, L. J. Diamond and H. C. Stillwell. The company is capitalized at $50,000 and proposes to design and construct electric generating plants and plants for generating gas.

THE EASTERN ELECTRIC COMPANY, of Cleveland, Ohio, has been chartered with a capital stock of $10,000 to do a general electrical business. The incorporators are: Charles Q. Nelson, Charles P. Salen, M. A. Salen, Hermon Arstin and Helena Smith.

THE ELECTRIC UNDERCURRENT COMPANY, of Pennsboro, W. Va., has been incorporated with a capital stock of $1,000,000 by H. L. Lambert, H. J. Scott, C. R. Cunningham, J. G. Young, G. P. Fought and E. Z. Weekly, all of Pennsboro. The company proposes to manufacture electrical appliances.

THE ELECTRIC VEHICLE BATTERY COMPANY, of Chicago, Ill., by Elbert C. Ferguson, Guy L. Eames and Ella A. O'Neill. The company is capitalized at $2,000 and proposes to do a manufacturing business.

THE ELSMERE ELECTRIC COMPANY, of Elsmere, Del., has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical apparatus and to carry on a general construction business. The officers are: A. H. Farge, of Batavia, N. Y., president; R. J. Forman, of Elsmere, vice-president and treasurer, and R. A. Shurter, of Elsmere, secretary.

THE ROBINSON ELECTRIC COMPANY, of St. Louis, Mo., has been incorporated with a capital stock of $2,000 by E. B. Robinson, R. H. Robinson and M. P. Ellis. The company proposes to deal in electrical supplies.

THE UNION LIGHT & SUPPLY COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $10,000 to deal in electric lamps. The incorporators are: Harry Hechheimer, 414 Law Building; Charles B. Slingluff and Parvis Ralph.

New Incorporations

DAWSON, GA.—The Co-operative Tel. & Teleg. Co. has been incorporated by J. M. Bell, C. D. Cooke, J. E. Morris, J. D. Bell and R. R. Martin, all of Dawson. The company is capitalized at $10,000 and will extend its line through Dawson, Cuthbert, Fort Gaines, Blakely and other towns.

OLNEY, ILL.—The Commercial Tel. & Tel. Co. has been incorporated with a capital stock of $500,000 to build and operate telephone and telegraph systems. The incorporators are: E. E. Gregg, H. H. Kile and H. H. Knipe.

SHABBONA, ILL.—The Inter Township Tel. Co. has been organized with a capital stock of $500,000 by C. H. Wilkinson, E. J. Brewer and Charles Schermerhorn. The company proposes to erect a telephone line to connect Lee, Shabbona, Waterman and Hinckley.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati Lt. & Pwr. Co. has been organized as an auxiliary company to the Indianapolis & Concinnati Trac. Co.'s properties. The company is capitalized at $900 and will supply electricity for lamps and motors to cities and towns and rural communities along the route of the traction company's lines.

ROLFE, KAN.—The Rolfe Lt. & Pwr. Co. has been incorporated with a capital stock of $20,000. The officers are: C. W. Siefkin, president; Robert Bruce, vice-president, and Ward Ferguson, secretary and treasurer.

ADAIRVILLE, KY.—Articles of incorporation have been filed for the Adairville Lt. & Htg. Co. by M. E. Orendorff, G. A. Smith and J. B. Fisher. The company proposes to construct an electric-light plant.

GLASGOW, KY.—The Glasgow Home Tel. Co. has been incorporated with a capital stock of $25,000 by T. P. Dickinson, W. B. Smith and H. P. Myers.

DETROIT, MICH.—The J. W. McNair El. Co. has filed articles of incorporation with a capital stock of $15,000. The incorporators are: J. W. McNair, Jesse Way and Alexander Bell.

MARCELLUS, N. Y.—The Marcellus Ltg. Co. has been incorporated with a capital stock of $10,000 for the purpose of supplying electricity in Marcellus, Skaneateles and Camillus. Power from Niagara Falls will be utilized, a transformer station having been erected at Marcellus Falls. For the present the activities of the company will be confined to furnishing electrical service in Marcellus and power to plant of the Lawless Paper Co. at Marcellus Falls. It is understood that service later will be extended to the towns of Skaneateles and Camillus. The directors are: Frank W. and Marion E. Knapp and Sidney Slocombe, of Marcellus.

THOMASVILLE, N. C.—Articles of incorporation have been filed for the Hambys Creek Tel. Co. with a capital stock of $10,000, by J. D. Carter, A. L. Bowers and Luther Grimes.

MAGNUM, OKLA.—The Consolidated Independent Tel. Co. has been chartered with a capital stock of $5,000. The incorporators are: D. H. Wright, T. P. Clay and J. H. Harriman.

ASPINWALL, PA.—The Delafield El. Lt. Co. has been incorporated with a capital stock of $5,000 by G. B. Fehr, of O'Hara Township; J. G. Marks, of Aspinwall; A. H. McNamee and J. Millholland, of Pittsburgh, and Lyman C. Shreve, of Erie.

DUNKARD, PA.—The Dunkard Township El. Co. has been incorporated with a capital stock of $5,000 by U. W. Tinker and D. M. McBride, of Pittsburgh, and C. M. Falck, of Bellevue. The office of the company is located in Pittsburgh.

HARRISBURG, PA.—Charters have been granted to six electric companies to operate in Lancaster County, as follows: The Conoy Township El. Co., Eden Township El. Co., West Earl Township Co., Ephrata Township El. Co., Upper Leacock El. Co. and Earl Township El. Co. Each company is capitalized at $5,000 and will operate in the district named. W. W. Greist, of Lancaster, is one of the incorporators.

ORANGEVILLE, ONT., CAN.—The Pine River Lt. & Pwr. Co., Ltd., has been incorporated with a capital stock of $200,000. The provisional directors are: F. H. Kilborn, H. B. Smith and James Garvie, all of Owen Sound.

Trade Publications

PIPE.—Bulletin No. 11 of the National Tube Company, Frick Building, Pittsburgh, Pa., refers to "National" pipe and contains a detailed statement defining the Spellerizing process.

COLORED LAMP HOODS.—Bulletin No. 22 issued recently by the Reynolds Electric Flasher Manufacturing Company, 617 West Jackson Boulevard, Chicago, Ill. is a descriptive folder containing illustrations in color of so-called Reco hoods.

ELECTRIC VEHICLES.—The Waverley Company, Indianapolis, Ind., has recently issued a bulletin for dealers, sizes 11 in. by 16 in. The latest models in the Waverley line are illustrated and described and some forcible selling talk to dealers is included.

BUSHINGS.—The Federal Sign System (Electric), Chicago, Ill., is sending out a four-page folder illustrating various types and sizes of bushings. A single, small-size bushing joining in the center the two pages of the folder gives a visual idea of the device.

ELECTRIC BLANKET.—The National Electric Company, 506 South Fifth Avenue, Chicago, Ill., has issued a small stretcher that tells about the "Ozone" electric blanket. This blanket makes it possible to secure invigorating sleep in fresh air, with sufficient warmth.

HEADGATES AND HEADGATE LIFTS.—C. D. Butchart, Denver, Col., has recently issued three new illustrated bulletins. No. 9 deals with headgate lifts, No. 10 with headgates for irrigation reservoirs, and No. 11 has for its subject standard headgates for lateral irrigation systems.

LIFTING MAGNETS.—An attractive catalog devoted to Browning lifting magnets has recently been brought out by the Browning Engineering Company, Cleveland, Ohio. It is 9 in. by 12 in., and contains many illustrations of typical installations of this apparatus. A brief description is given and a sectional view of the construction of the magnet is shown

SOCKETS.—Pass & Seymour, Inc., is distributing Bulletin 750, which deals with its Presto interchangeable sockets. The arrangement of the inside double page—which is only half the width of the outside pages—shows how it is possible to make up twenty-four different combinations of sockets or receptacles from fifteen parts. A part of one socket can be pictorially laid against some other type and the resultant combination is graphically shown.

Business Notes

THE ALBERGER PUMP & CONDENSER COMPANY, 140 Cedar Street, New York, announces that it now possesses the exclusive right to manufacture and sell the Hammond meter. This device is used for measuring boiler-feed water and other fluids.

THE PACIFIC STATES ELECTRIC COMPANY, 307 First Avenue South, Seattle, Wash., with branch offices at Portland, Ore., San Francisco, Los Angeles and Oakland, Cal., has purchased the Holabird Electric Company, of Seattle, and will continue to carry a complete stock of electrical supplies.

THE SOUTHERN TIER ENGINEERING COMPANY, INC., has entered the engineering field in the section of New York State known as the Southern Tier, with its offices at No. 738 Security Mutual Building, Binghamton, N. Y. This company will engage in the consulting and designing branch of the industry and will specialize in energy transmission and the design of special machines.

THE ALPHA ELECTRICAL SUPPLY COMPANY in January will move from its present location at 130 West Thirty-second Street to 116-118 West Twenty-ninth Street, New York. In its new quarters it will occupy two floors, which contain 8000 sq. ft. of area, and it is the intention of the company to open one of the best equipped and most modern electrical supply stores in New York City. Mr. John F. Walsh is president and general manager.

FAIRBANKS, MORSE & COMPANY, Chicago, Ill., have announced that Mr. Cyril J. Atkinson, patentee of the Atkinson gas producer, has become associated with this company. A number of Mr. Atkinson's designs will be incorporated in the Fairbanks-Morse gas producers at once, and his services will be placed at the disposal of the public for adapting the Fairbanks-Morse product to meet the requirements of the various industries desiring to substitute producer gas for fuel oil.

LOTZ & SCHEIBLE.—Messrs. Rudolph W. Lotz and Albert Scheible have announced the formation of a partnership under the firm name of Lotz & Scheible for the purpose of practising patent and trade-mark law and of soliciting patents and the registration of trade marks in all countries. The new firm will have offices at 1601 McCormick Building, 332 South Michigan Avenue, Chicago. Mr. Lotz has devoted the past seventeen years to practice before the Patent Office and the United States courts in matters pertaining to patents and trade marks. Mr. Scheible is a mechanical and electrical engineer and solicitor of patents. He is a graduate of Purdue and Cornell Universities and has had twenty years' practical experience with the development of inventions from the engineering and manufacturing standpoint and as an expert in patent cases.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, Matthew R. Boylan, Public Service Railway Co., Newark, N. J.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 E. 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Geo. C. Halberton, Pacific Gas & Elec. Co., San Francisco, Cal.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Col.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Annual meeting, Syracuse, N. Y., Jan. 21, 1913.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRICAL VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d Street, New York. Meeting, fourth Tuesday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT AND POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary and treasurer, J. V. Zartman, 120 So. Meridian St., Indianapolis, Ind.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting, first Monday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 W. Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barr, Exposition Bldg., San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, H. B. Maynard, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

JOVIAN ORDER. Jupiter (president), F. E. Watts, Western Electric Co., New York; Mercury (secretary), E. C. Bennett, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, W. H. Fellows, Leavenworth, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Indianapolis, Ind., May 27-29, 1913.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, Chicago, May, 1913.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. H. Carlton, General Electric Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-treasurer, M. H. Hendle, Augusta, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, Farley Osgood, Public Service Electric Company, Newark, N. J.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass. Next annual meeting, New York, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Electric Development Association. Secretary, Zenas W. Carter, 53 State St., Boston, Mass.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

New York Electric Railway Association. Secretary, Charles C. Dietz, United Traction Company, Albany, N. Y.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

Pittsburgh Electrical Booster Club. Recording Watt, George H. Criss, 1806 Union Bank Building, Pittsburgh, Pa. Meeting, first Monday each month.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa.

Society for Electrical Development, Inc. Secretary, Philip S. Dodd, 29 West 39th Street, New York.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

Southwestern Electrical and Gas Association Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo., Jan. 28-30, 1913.

Western Society of Engineers. Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 26, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,045,141. CIRCUIT-BREAKER; W. F. Hanst, Carnegie, Pa. App. filed May 25, 1911. For open-circuit work on local battery in telegraphy.

1,045,147. PROCESS OF MAKING AND MOUNTING COMMUTATORS; F. P. Huyck, Toledo, Ohio. App. filed Dec. 4, 1909. A ring is separated into segments after mounting.

1,045,158. DYNAMO-ELECTRIC MACHINE; R. Lundell, New York, N. Y. App. filed Feb. 20, 1909. Direct-current machine with positive commutating field.

1,045,159. INTERPOLE FIELD MAGNET; R. Lundell, New York, N. Y. App. filed Feb. 7, 1910. Laminated field and rigid skeleton frame.

1,045,212. ELECTRICAL CONTACT; H. F. Stratton, Cleveland, Ohio. App. filed Aug. 19, 1912. Yielding contact for drum-type controller.

1,045,256. OUTLET BOX; O. Carman, Indianapolis, Ind. App. filed Sept. 28, 1908. Adjustable leveling floor plate.

1,045,262. TROLLEY HANGER; R. O. Couch, Charleston, W. Va. App. filed May 24, 1911. Parts for simultaneously clamping the wire and the support.

1,045,271. SIGNALING CIRCUIT FOR TRAIN DISPATCHING; J. C. Field, Orange, N. J. App. filed April 5, 1911. Party-line selective step-by-step devices.

1,045,280. SPRING CONNECTOR; T. G. Grier and H. M. Fisk, Chicago, Ill. App. filed April 8, 1912. Binding post clip.

1,045,288. OIL SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed Feb. 23, 1906. Fluid-pressure-operated mechanism.

1,045,291. BATTERY-CHARGE INDICATION; W. E. Holland, East Orange, N. J. App. filed June 10, 1911. Depends upon observing the gas bubbles given off.

1,045,306. BUSY-TEST SYSTEM FOR PARTY-TELEPHONE LINES; F. R. McBerty, New Rochelle, N. Y. App. filed Dec. 18, 1909. Separate test terminal for each responsive device.

1,045,310. SANITARY DEVICE FOR TELEPHONES; I. P. Mills, San Francisco, Cal. App. filed June 29, 1911. Antiseptic mouthpiece ring.

1,045,318. AUTOMATIC KEYBOARD PLAYER; C. W. Nyström, Karlstad, Sweden. App. filed March 25, 1909. Two or more cutting tools for forming impressions.

1,045,320. ELECTRIC HEATER FOR RANGES; L. F. Parkhurst, Binghamton, N. Y. App. filed Nov. 25, 1911. To be used with gas stoves, etc.

1,045,332. PORTABLE ELECTRIC WELDING TOOL; J. W. Sheffer, Berwick, Pa. App. filed May 13, 1912. Hand tool.

1,045,353. INSULATOR FOR AUTOMATICALLY SECURING CONDUCTING WIRES; F. Zachhuber, Nuremberg, Germany. App. filed Oct. 26, 1911. Slotted head and clamp.

1,045,361. RHEOSTAT; L. Beck, Norwood, Ohio. App. filed Oct. 2, 1909. For internal-combustion motor switchboard.

1,045,394. AUTOMATIC SWITCH; W. Griebe and D. C. Ruth, Brooklyn, N. Y. App. filed Nov. 18, 1911. Cut-out automatically operated by the knee. For linotypes, etc.

1,045,413. INDUCTIVE TELEPHONE AND TELEGRAPHING INSTALLATION; H. Von Kramer, Erdington, Birmingham, England. App. filed Aug. 17, 1911. Wireless apparatus for railroad trade use.

1,045,444. ELECTRIC PIANO; H. K. Sandell, Chicago, Ill. App. filed July 5, 1910. Control of tone modifying.

1,045,463. AUTOMATIC SAFETY DEVICE FOR RAILWAYS; E. Unverricht, Hamburg, Germany. App. filed Aug. 17, 1910. Tilting circuit changer.

1,045,496. AUTOMOBILE CONTROL; I. F. Baker, East Orange, N. J. App. filed June 7, 1909. Combination gasoline motor, electric generator and electric drive.

1,045,515. TELEPHONE EXCHANGE SYSTEM; E. E. Clement, Washington, D. C. App. filed April 15, 1905. Divided multiple switchboard.

1,045,536. INSULATOR PIN; C. G. Ette, St. Louis, Mo. App. filed March 30, 1912. Metal pin designed to avoid breaking the insulator.

1,045,538. TROLLEY MECHANISM; D. T. Fisher, Columbus, Ohio. App. filed April 16, 1910. Spring and hinged support for mine use, etc.

1,045,546. CENTRAL ENERGY TELEPHONE SYSTEM; C. L. Goodrum, Philadelphia, Pa. App. filed April 6, 1903. Line and supervisory signaling devices.

1,045,572. SWITCH AND CONNECTING DEVICE FOR ELECTRIC CONDUCTORS; N. D. Levin, Columbus, Ohio. App. filed March 25, 1910. Inclosed contacts for mine use, etc.

1,045,575. METHOD OF LOCATING SUBTERRANEAN STRATA; H. Löwy, Göttingen, Germany. App. filed June 3, 1912. Testing by means of wireless waves of known length.

1,045,581. FOLDABLE SHOE FOR THIRD-RAIL ELECTRIC CARS; L. A. McCourrie and C. F. Raydure, Philadelphia, Pa. App. filed June 8, 1912. Hinged spring pressed and adjustable.

1,045,600. TELEPHONE TRANSMISSION SYSTEM; J. C. R. Palmer, Brooklyn, N. Y. App. filed Dec. 16, 1910. For long-distance substation work.

1,045,615. ELECTRIC SOLDERING IRON; F. A. Sandstrom, Chicago, Ill. App. filed Sept. 5, 1911. Arc between copper tip and carbon pencil.

1,045,626. TERMINAL FOR BRANCH LINES OF DIFFERENT CROSS-SECTION; H. Starcke, Cologne, Germany. App. filed Oct. 2, 1911. V-shaped spring clip.

1,045,638. ELECTROTHERMOSTATIC TEMPERATURE CONTROLLER; B. F. Teal, Glenside, Pa. App. filed July 30, 1910. Motor-actuated dampers and indicator.

1,045,641. VAPOR ELECTRIC DEVICE; E. Thompson, Swampscott, Mass. App. filed Dec. 7, 1906. Gas is driven into an extension and sealed off.

1,045,659. FUSE; J. H. Alspach, Pittsburgh, Pa. App. filed March 1, 1912. Cartridge type with detachable cap ends.

1,045,679. TOOL FOR MANIPULATING WIRES ON HIGH-VOLTAGE CIRCUITS; J. Cronin, Wapakoneta, Ohio. App. filed May 13, 1912. An insulator is interposed between the operating and handle ends.

1,045,680. IMPLEMENT FOR MANIPULATING WIRES ON HIGH-VOLTAGE CIRCUITS; J. Cronin, Wapakoneta, Ohio. App. filed May 13, 1912. The handle carries an insulator with wire hooks.

1,045,686. INDICATOR; A. F. Dixon, New York, N. Y. App. filed Sept. 26, 1908. For semi-automatic telephone-exchange trunk line.

1,045,692. ELECTRIC SWITCH; A. G. FitzGerald, Haverhill, Mass. App. filed June 23, 1911. Solenoid-operated.

1,045,697. CABLE TERMINAL STRUCTURE; S. P. Grace, Pittsburgh, Pa. App. filed Jan. 15, 1908. Air-bell cover for underground cable work.

1,045,703. ARC-LAMP CUT-OUT; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Aug. 27, 1908. Spring-pressed ball contacts.

1,045,706. ELECTRIC HORN; M. E. Hepburn, Elgin, Ill. App. filed Oct. 26, 1911. Electromagnetically operated diaphragm.

1,045,718. TREATMENT OF SURFACES OF ALUMINUM OR ITS ALLOYS FOR THE DEPOSITION OF METALS THEREON; O. Marino, Golders Green, London, England. App. filed April 29, 1912. The surface is treated with fluoride and potassium tartrate.

1,045,733. ELECTRIC SWITCH; A. H. Nero, New Britain, Conn. App. filed Oct. 7, 1911. Two-piece porcelain-base and lamp-socket type.

1,045,758. TROLLEY; L. J. Tetlow, West Springfield, Mass. App. filed, May 12, 1911. Spring contacts.

1,045,769. PROCESS FOR THE REDUCTION OF SULPHATES; V. Bollo and E. Cadenaccio, Genoa, Italy. App. filed Nov. 21, 1910. The material is heated with a reducing agent and a catalytic agent.

1,045,773. QUICK-ACTION ELECTRIC SWITCH; J. A. Cole, New York, N. Y. App. filed Aug. 30, 1911. The parts are inclosed behind the switchboard.

THE ELECTRICAL WORLD'S

STREET-LIGHTING TABLES FOR 1913

TWENTY-FOURTH YEAR

These schedules are based on local mean time. Where standard time is used, and it varies considerably from sun time, the proper deduction or addition must be made.

Time from noon until midnight is in bold-face type; that from midnight until noon in light type. The light type shows time for the morning following the date of the night indicated.

January, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**5:15**	6:20	**5:15**	4:00	**5:15**	4:00
2	**5:15**	6:20	**5:15**	5:10	**5:15**	5:10
3	**5:15**	6:20	**5:15**	6:20	**5:15**	6:20
4	**5:15**	6:20	**5:15**	6:20	**5:15**	6:20
5	**5:15**	6:20	**5:15**	6:20	**5:15**	6:20
6	**5:15**	6:20	**5:15**	6:20	**5:15**	6:20
7	**5:20**	6:20	**5:20**	6:20	**5:20**	6:20
8	**5:20**	6:20	**5:20**	6:20	**5:20**	6:20
9	**5:20**	6:20	**5:20**	6:20	**5:20**	6:20
10	**5:20**	6:20	**6:55**	6:20	**5:20**	6:20
11	**5:20**	6:20	**8:00**	6:20	**5:20**	6:20
12	**5:25**	6:20	**9:00**	6:20	**5:25**	6:20
13	**5:25**	6:20	**10:00**	6:20	**5:25**	6:20
14	**5:25**	6:20	**11:05**	6:20	**5:25**	6:20
15	**5:25**	6:15	12:10	6:15	**5:25**	6:15
16	**5:25**	6:15	1:20	6:15	**5:25**	**12:00**
16	.....	.....	.....	.....	1:20	6:15
17	**5:30**	6:15	2:35	6:15	**5:30**	**12:00**
17	.....	.....	.....	.....	2:35	6:15
18	**5:30**	6:15	3:45	6:15	**5:30**	**12:00**
18	.....	.....	.....	.....	3:45	6:15
19	**5:30**	6:15	5:00	6:15	**5:30**	**12:00**
19	.....	.....	.....	.....	5:00	8:15
20	**5:30**	6:15	No	light	**5:30**	**12:00**
21	**5:30**	6:15	No	light	**5:30**	**12:00**
22	**5:35**	6:15	No	light	**5:35**	**12:00**
23	**5:35**	6:15	**5:35**	**7:25**	**5:35**	**12:00**
24	**5:35**	6:15	**5:35**	**8:45**	**5:35**	**12:00**
25	**5:40**	6:10	**5:40**	**10:05**	**5:40**	**12:00**
26	**5:40**	6:10	**5:40**	**11:25**	**5:40**	**12:00**
27	**5:40**	6:10	**5:40**	12:35	**5:40**	12:35
28	**5:40**	6:10	**5:40**	1:50	**5:40**	1:50
29	**5:45**	6:10	**5:45**	3:00	**5:45**	3:00
30	**5:45**	6:10	**5:45**	4:10	**5:45**	4:10
31	**5:45**	6:05	**5:45**	5:15	**5:45**	5:15

February, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**5:45**	6:05	**5:45**	6:05	**5:45**	6:05
2	**5:45**	6:05	**5:45**	6:05	**5:45**	6:05
3	**5:45**	6:05	**5:45**	6:05	**5:45**	6:05
4	**5:45**	6:05	**5:45**	6:05	**5:45**	6:05
5	**5:50**	6:00	**5:50**	6:00	**5:50**	6:00
6	**5:50**	6:00	**5:50**	6:00	**5:50**	6:00
7	**5:55**	6:00	**5:55**	6:00	**5:55**	6:00
8	**5:55**	6:00	**6:55**	6:00	**5:55**	6:00
9	**5:55**	6:00	**7:55**	6:00	**5:55**	6:00
10	**5:55**	5:55	**8:55**	5:55	**5:55**	5:55
11	**6:00**	5:55	**10:00**	5:55	**6:00**	5:55
12	**6:00**	5:55	**11:05**	5:55	**6:00**	5:55
13	**6:00**	5:55	12:15	5:55	**6:00**	5:55
14	**6:05**	5:50	1:25	5:50	**6:05**	**12:00**
14	.....	.....	.....	.....	1:25	5:50
15	**6:05**	5.50	2:40	5:50	**6:05**	**12:00**
15	.....	.....	.....	.....	2:40	5:50
16	**6:05**	5:50	3:40	5:50	**6:05**	**12:00**
16	.....	.....	.....	.....	3:40	5:50
17	**6:10**	5:50	4:35	5:50	**6:10**	**12:00**
17	.....	.....	.....	.....	4:35	5:50
18	**6:10**	5:45	No	light	**6:10**	**12:00**
19	**6:10**	5:45	No	light	**6:10**	**12:00**
20	**6:10**	5:45	No	light	**6:10**	**12:00**
21	**6:10**	5:45	**6:10**	**7:35**	**6:10**	**12:00**
22	**6:10**	5:40	**6:10**	**8:55**	**6:10**	**12:00**
23	**6:15**	5:40	**6:15**	**10:15**	**6:15**	**12:00**
24	**6:15**	5:40	**6:15**	**11:30**	**6:15**	**12:00**
25	**6:15**	5:35	**6:15**	12:45	**6:15**	12:45
26	**6:15**	5:35	**6:15**	2:00	**6:15**	2:00
27	**6:15**	5:35	**6:15**	3:10	**6:15**	3:10
28	**6:20**	5:30	**6:20**	4:10	**6:20**	4:10

March, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30
2	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30
3	**6:20**	5:30	**6:20**	5:30	**6:20**	5:30
4	**6:25**	5:30	**6:25**	5:30	**6:25**	5:30
5	**6:25**	5:25	**6:25**	5:25	**6:25**	5:25
6	**6:25**	5:20	**6:25**	5:20	**6:25**	5:20
7	**6:25**	5:20	**6:25**	5:20	**6:25**	5:20
8	**6:25**	5:20	**6:25**	5:20	**6:25**	5:20
9	**6:30**	5:20	**6:45**	5:20	**6:30**	5:20
10	**6:30**	5:15	**7:50**	5:15	**6:30**	5:15
11	**6:30**	5:15	**8:55**	5:15	**6:30**	5:15
12	**6:30**	5:15	**10:05**	5:15	**6:30**	5:15
13	**6:30**	5:10	**11:15**	5:10	**6:30**	5:10
14	**6:35**	5:10	12:25	5:10	**6:35**	5:10
15	**6:35**	5:10	1:30	5:10	**6:35**	**12:00**
15	.....	.....	.....	.....	1:30	5:10
16	**6:35**	5:05	2:25	5:05	**6:35**	**12:00**
16	.....	.....	.....	.....	2:25	5:05
17	**6:35**	5:05	3:10	5:05	**6:35**	**12:00**
17	.....	.....	.....	.....	3:10	5:05
18	**6:35**	5:05	3:45	5:05	**6:35**	**12:00**
18	.....	.....	.....	.....	3:45	5:05
19	**6:40**	5:05	4:15	5:05	**6:40**	**12:00**
19	.....	.....	.....	.....	4:15	5:05
20	**6:40**	5:00	No	light	**6:40**	**12:00**
21	**6:40**	5:00	No	light	**6:40**	**12:00**
22	**6:40**	4:55	No	light	**6:40**	**12:00**
23	**6:45**	4:55	**6:45**	**9:05**	**6:45**	**12:00**
24	**6:45**	4:55	**6:45**	**10:25**	**6:45**	**12:00**
25	**6:45**	4:55	**6:45**	**11:40**	**6:45**	**12:00**
26	**6:45**	4:50	**6:45**	12:55	**6:45**	12:55
27	**6:45**	4:50	**6:45**	2:00	**6:45**	2:00
28	**6:50**	4:50	**6:50**	3:00	**6:50**	3:00
29	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
30	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
31	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45

April, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
2	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
3	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
4	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
5	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
6	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
7	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
8	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
9	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
10	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
11	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
12	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
13	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
14	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
15	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
16	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
17	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
18	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
19	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
20	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
21	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
22	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
23	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
24	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
25	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
26	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
27	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
28	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
29	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
30	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45

May, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
2	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
3	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
4	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
5	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
6	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
7	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
8	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
9	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
10	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
11	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
12	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
13	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
14	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
15	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
16	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
17	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
18	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
19	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
20	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
21	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
22	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
23	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
24	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
25	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
26	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
27	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
28	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
29	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
30	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
31	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45

June, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
2	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
3	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
4	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
5	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
6	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
7	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
8	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
9	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
10	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
11	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
12	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
13	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
14	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
15	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
16	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
17	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
18	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
19	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
20	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
21	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
22	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
23	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
24	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
25	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
26	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
27	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
28	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
29	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45
30	**6:50**	4:45	**6:50**	4:45	**6:50**	4:45

April, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	6:50	4:45	6:50	4:45	6:50	3:15
2	6:55	4:40	6:55	4:40	6:55	4:35
3	6:55	4:40	6:55	4:40	6:55	4:40
4	6:55	4:35	6:55	4:35	6:55	4:30
5	6:55	4:35	6:55	4:35	6:55	4:35
6	6:55	4:35	6:55	4:35	6:55	4:35
7	7:00	4:35	7:00	4:35	7:00	4:35
8	7:00	4:30	7:55	4:30	7:00	4:30
9	7:00	4:30	9:05	4:30	7:00	4:30
10	7:00	4:30	10:15	4:30	7:00	4:30
11	7:00	4:25	11:20	4:25	7:00	4:25
12	7:05	4:25	12:20	4:25	7:05	4:25
13	7:05	4:25	1:05	4:25	7:05	12:00
13	.....	.....	.....	.....	1:05	4:25
14	7:05	4:20	1:45	4:20	7:05	12:00
14	.....	.....	.....	.....	1:45	4:20
15	7:05	4:20	2:15	4:20	7:05	12:00
15	.....	.....	.....	.....	2:15	4:20
16	7:05	4:20	2:45	4:20	7:05	12:00
16	.....	.....	.....	.....	2:45	4:20
17	7:10	4:15	3:05	4:15	7:10	12:00
17	.....	.....	.....	.....	3:05	4:15
18	7:10	4:15	No	light	7:10	12:00
19	7:10	4:15	No	light	7:10	12:00
20	7:10	4:10	No	light	7:10	12:00
21	7:10	4:10	7:10	9:10	7:10	12:00
22	7:15	4:10	7:15	10:30	7:15	12:00
23	7:15	4:05	7:15	11:40	7:15	12:00
24	7:15	4:05	7:15	12:45	7:15	12:45
25	7:15	4:05	7:15	1:35	7:15	1:35
26	7:20	4:05	7:20	2:20	7:20	2:20
27	7:20	4:00	7:20	2:50	7:20	2:50
28	7:20	4:00	7:20	3:15	7:20	3:15
29	7:20	4:00	7:20	3:40	7:20	3:40
30	7:20	4:00	7:20	4:00	7:20	4:00

May, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	7:20	4.00	7:20	4:00	7:20	4:00
2	7:20	4:00	7:20	4:00	7:20	4:00
3	7:25	3:55	7:25	3:55	7:25	3:55
4	7:25	3:55	7:25	3:55	7:25	3:55
5	7:25	3:55	7:25	3:55	7:25	3:55
6	7:25	3:50	7:25	3:50	7:25	3:50
7	7:25	3:45	8:05	3:45	7:25	3:45
8	7:30	3:45	9:15	3:45	7:30	3:45
9	7:30	3:45	10:15	3:45	7:30	3:45
10	7:30	3:45	11:05	3:45	7:30	3:45
11	7:30	3:45	11:45	3:45	7:30	3:45
12	7:30	3:45	12:20	3:45	7:30	3:45
13	7:35	3:45	12:45	3:45	7:35	12:00
13	.....	.....	.....	.....	12:45	3:45
14	7:35	3:45	1:10	3:45	7:35	12:00
14	.....	.....	.....	.....	1:10	3:45
15	7:35	3:40	1:30	3:40	7:35	12:00
15	.....	.....	.....	.....	1:30	3:40
16	7:35	3:40	1:55	3:40	7:35	12:00
16	.....	.....	.....	.....	1:55	3:40
17	7:35	3:40	2:20	3:40	7:35	12:00
17	.....	.....	.....	.....	2:20	3:40
18	7:40	3:40	No	light	7:40	12:00
19	7:40	3:40	No	light	7:40	12:00
20	7:40	3:40	No	light	7:40	12:00
21	7:40	3:35	7:40	10:30	7:40	12:00
22	7:40	3:35	7:40	11:30	7:40	12:00
23	7:45	3:35	7:45	12:15	7:45	12:15
24	7:45	3:35	7:45	12:50	7:45	12:50
25	7:45	3:35	7:45	1:20	7:45	1:20
26	7:45	3:35	7:45	1:40	7:45	1:40
27	7:45	3:35	7:45	2:00	7:45	2:00
28	7:45	3:35	7:45	2:20	7:45	2.20
29	7:45	3:35	7:45	2:35	7:45	2:35
30	7:45	3:30	7:45	2:55	7:45	2:55
31	7:45	3:30	7:45	3:15	7:45	3:15

June, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	7:50	3:35	7:50	3:35	7:50	3:35
2	7:50	3:35	7:50	3:35	7:50	3:35
3	7:50	3:35	7:50	3:35	7:50	3:35
4	7:50	3:35	7:50	3:35	7:50	3:35
5	7:50	3:35	8:10	3:35	7:50	3:35
6	7:55	3:35	9:00	3:35	7:55	3:35
7	7:55	3:35	9:45	3:35	7:55	3:35
8	7:55	3:35	10:20	3:35	7:55	3:35
9	7:55	3:35	10:50	3:35	7:55	3:35
10	7:55	3:35	11:15	3:35	7:55	3:35
11	7:55	3:35	11:35	3:35	7:55	3:35
12	7:55	3:30	12:00	3:30	7:55	3:35
13	7:55	3:30	12:20	3:30	7:55	3:35
14	7:55	3:30	12:45	3:30	7:55	12:00
14	.....	.....	.....	.....	12:45	3:30
15	7:55	3:30	1:20	3:30	7:55	12:00
15	.....	.....	.....	.....	1:20	3:30
16	7:55	3:30	1:55	3:30	7:55	12:00
16	.....	.....	.....	.....	1:55	3:30
17	8:00	3:30	No	light	8:00	12:00
18	8:00	3:30	No	light	8:00	12:00
19	8:00	3:30	8:00	10:05	8:00	12:00
20	8:00	3:30	8:00	10:45	8:00	12:00
21	8:00	3:30	8:00	11:15	8:00	12:00
22	8:00	3:30	8:00	11:45	8:00	12:00
23	8:00	3:30	8:00	12:05	8:00	12:05
24	8:00	3:30	8:00	12:25	8:00	12:25
25	8:00	3:30	8:00	12:40	8:00	12:40
26	8:00	3:30	8:00	1:00	8:00	1:00
27	8:00	3:30	8:00	1:15	8:00	1:15
28	8:00	3:30	8:00	1:40	8:00	1:40
29	8:00	3:30	8:00	2:05	8:00	2:05
30	8:00	3:30	8:00	2:35	8:00	2:35

July, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	8:00	3:30	8:00	3:20	8:00	3:20
2	8:00	3:30	8:00	3:30	8:00	3:30
3	8:00	3:30	8:00	3:30	8:00	3:30
4	8:00	3:30	8:00	3:30	8:00	3:30
5	8:00	3:30	8:20	3:30	8:00	3:30
6	8:00	3:30	8:50	3:30	8:00	3:30
7	8:00	3:30	9:20	3:30	8:00	3:30
8	8:00	3:30	9:40	3:30	8:00	3:30
9	8:00	3:35	10:00	3:35	8:00	3:35
10	8:00	3:35	10:25	3:35	8:00	3:35
11	7:55	3:35	10:50	3:35	7:55	3:35
12	7:55	3:35	11:20	3:35	7:55	3:35
13	7:55	3:35	11:55	3:35	7:55	3:35
14	7:55	3:40	12:35	3:40	7:55	3:40
15	7:55	3:40	1:30	3:40	7:55	12:00
15	.....	.....	.....	.....	1:30	3:40
16	7:55	3:40	2:30	3:40	7:55	12:00
16	.....	.....	.....	.....	2:30	3:40
17	7:55	3:45	No	light	7:55	12:00
18	7:55	3:45	No	light	7:55	12:00
19	7:55	3:45	No	light	7:55	12:00
20	7:50	3:45	No	light	7:50	12:00
21	7:50	3:45	7:50	10:10	7:50	12:00
22	7:50	3:45	7:50	10:30	7:50	12:00
23	7:50	3:50	7:50	10:45	7:50	12:00
24	7:50	3:50	7:50	11:05	7:50	12:00
25	7:50	3:50	7:50	11:20	7:50	12:00
26	7:50	3:50	7:50	11:40	7:50	12:00
27	7:45	3:50	7:45	12:05	7:45	12:05
28	7:45	3:55	7:45	12:30	7:45	12:30
29	7:45	3:55	7:45	1:00	7:45	1:00
30	7:45	3:55	7:45	3:00	7:45	3:00
31	7:40	3:55	7:40	3:55	7:40	3:55

August, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	7:40	3:55	7:40	3:55	7:40	3:55
2	7:40	3:55	7:40	3:55	7:40	3:55
3	7:40	4:00	7:40	4:00	7:40	4:00
4	7:40	4:00	7:40	4:00	7:40	4:00
5	7:35	4:00	8:05	4:00	7:35	4:00
6	7:35	4:00	8:30	4:00	7:35	4:00
7	7:35	4:00	8:50	4:00	7:35	4:00
8	7:35	4:00	9:20	4:00	7:35	4:00
9	7:30	4:05	9:55	4:05	7:30	4:05
10	7:30	4:05	10:35	4:05	7:30	4:05
11	7:30	4:05	11:25	4:05	7:30	4:05
12	7:30	4:05	12:20	4:05	7:30	4:05
13	7:25	4:05	1:25	4:05	7:25	12:00
13	.....	.....	.....	.....	1:25	4:05
14	7:25	4:10	2:30	4:10	7:25	12:00
14	.....	.....	.....	.....	2:30	4:10
15	7:25	4:10	No	light	7:25	12:00
16	7:25	4:10	No	light	7:25	12:00
17	7:20	4:10	No	light	7:20	12:00
18	7:20	4:10	7:20	8:50	7:20	12:00
19	7:20	4:15	7:20	9:10	7:20	12:00
20	7:15	4:15	7:15	9:25	7:15	12:00
21	7:15	4:15	7:15	9:45	7:15	12:00
22	7:15	4:15	7:15	10:05	7:15	12:00
23	7:15	4:15	7:15	10:30	7:15	12:00
24	7:10	4:20	7:10	11:05	7:10	12:00
25	7:10	4:20	7:10	11:50	7:10	12:00
26	7:10	4:20	7:10	12:40	7:10	12:40
27	7:05	4:20	7:05	1:45	7:05	1:45
28	7:05	4:20	7:05	3:05	7:05	3:05
29	7:05	4:25	7:05	4:25	7:05	4:25
30	7:05	4:25	7:05	4:25	7:05	4:25
31	7:00	4:25	7:00	4:25	7:00	4:25

September, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	7:00	4:25	7:00	4:25	7:00	4:25
2	7:00	4:25	7:00	4:25	7:00	4:25
3	6:55	4:30	6:55	4:30	6:55	4:30
4	6:55	4:30	7:20	4:30	6:55	4:30
5	6:55	4:30	7:55	4:30	6:55	4:30
6	6:50	4:30	8:30	4:30	6:50	4:30
7	6:50	4:30	9:20	4:30	6:50	4:30
8	6:50	4:30	10:15	4:30	6:50	4:30
9	6:45	4:35	11:15	4:35	6:45	4:35
10	6:45	4:35	12:20	4:35	6:45	4:35
11	6:45	4:35	1:30	4:35	6:45	12:00
11	.....	.....	.....	.....	1:30	4:35
12	6:40	4:35	2:35	4:35	6:40	12:00
12	.....	.....	.....	.....	2:35	4:35
13	6:40	4:35	3:35	4:35	6:40	12:00
13	.....	.....	.....	.....	3:35	4:35
14	6:40	4:35	No	light	6:40	12:00
15	6:35	4:40	No	light	6:35	12:00
16	6:35	4:40	No	light	6:35	12:00
17	6:35	4:40	6:35	7:50	6:35	12:00
18	6:30	4:40	6:30	8:10	6:30	12:00
19	6:30	4:45	6:30	8:35	6:30	12:00
20	6:30	4:45	6:30	9:05	6:30	12:00
21	6:25	4:45	6:25	9:40	6:25	12:00
22	6:25	4:45	6:25	10:30	6:25	12:00
23	6:25	4:45	6:25	11:30	6:25	12:00
24	6:20	4:50	6:20	12:40	6:20	12:40
25	6:20	4:50	6:20	2:00	6:20	2:00
26	6:20	4:50	6:20	3:20	6:20	3:20
27	6:15	4:50	6:15	4:40	6:15	4:40
28	6:15	4:55	6:15	4:55	6:15	4:55
29	6:15	4:55	6:15	4:55	6:15	4:55
30	6:15	4:55	6:15	4:55	6:15	4:55

October, 1913

November, 1913

December, 1913

July, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**8:00**	3:30	**8:00**	3:20	**8:00**	3:20
2	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
3	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
4	**8:00**	3:30	**8:00**	3:30	**8:00**	3:30
5	**8:00**	3:30	**8:20**	3:30	**8:00**	3:30
6	**8:00**	3:30	**8:50**	3:30	**8:00**	3:30
7	**8:00**	3:30	**9:20**	3:30	**8:00**	3:30
8	**8:00**	3:30	**9:40**	3:30	**8:00**	3:30
9	**8:00**	3:35	**10:00**	3:35	**8:00**	3:35
10	**8:00**	3:35	**10:25**	3:35	**8:00**	3:35
11	**7:55**	3:35	**10:50**	3:35	**7:55**	3:35
12	**7:55**	3:35	**11:20**	3:35	**7:55**	3:35
13	**7:55**	3:35	**11:55**	3:35	**7:55**	3:35
14	**7:55**	3:40	12:35	3:40	**7:55**	3:40
15	**7:55**	3:40	1:30	3:40	**7:55**	**12:00**
15	.....	.....	.....	.....	1:30	3:40
16	**7:55**	3:40	2:30	3:40	**7:55**	**12:00**
16	.....	.....	.....	.....	2:30	3:40
17	**7:55**	3:45	No	light	**7:55**	**12:00**
18	**7:55**	3:45	No	light	**7:55**	**12:00**
19	**7:55**	3:45	No	light	**7:55**	**12:00**
20	**7:50**	3:45	No	light	**7:50**	**12:00**
21	**7:50**	3:45	**7:50**	**10:10**	**7:50**	**12:00**
22	**7:50**	3:45	**7:50**	**10:30**	**7:50**	**12:00**
23	**7:50**	3:50	**7:50**	**10:45**	**7:50**	**12:00**

August, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**7:40**	3:55	**7:40**	3:55	**7:40**	3:55
2	**7:40**	3:55	**7:40**	3:55	**7:40**	3:55
3	**7:40**	4:00	**7:40**	4:00	**7:40**	4:00
4	**7:40**	4:00	**7:40**	4:00	**7:40**	4:00
5	**7:35**	4:00	**8:05**	4:00	**7:35**	4:00
6	**7:35**	4:00	**8:30**	4:00	**7:35**	4:00
7	**7:35**	4:00	**8:50**	4:00	**7:35**	4:00
8	**7:35**	4:00	**9:20**	4:00	**7:35**	4:00
9	**7:30**	4:05	**9:55**	4:05	**7:30**	4:05
10	**7:30**	4:05	**10:35**	4:05	**7:30**	4:05
11	**7:30**	4:05	**11:25**	4:05	**7:30**	4:05
12	**7:30**	4:05	12:20	4:05	**7:30**	4:05
13	**7:25**	4:05	1:25	4:05	**7:25**	**12:00**
13	.....	.....	.....	.....	1:25	4:05
14	**7:25**	4:10	2:30	4:10	**7:25**	**12:00**
14	.....	.....	.....	.....	2:30	4:10
15	**7:25**	4:10	No	light	**7:25**	**12:00**
16	**7:25**	4:10	No	light	**7:25**	**12:00**
17	**7:20**	4:10	No	light	**7:20**	**12:00**
18	**7:20**	4:10	**7:20**	**8:50**	**7:20**	**12:00**
19	**7:20**	4:15	**7:20**	**9:10**	**7:20**	**12:00**
20	**7:15**	4:15	**7:15**	**9:25**	**7:15**	**12:00**
21	**7:15**	4:15	**7:15**	**9:45**	**7:15**	**12:00**
22	**7:15**	4:15	**7:15**	**10:05**	**7:15**	**12:00**
23	**7:15**	4:15	**7:15**	**10:30**	**7:15**	**12:00**

September, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	**7:00**	4:25	**7:00**	4:25	**7:00**	4:25
2	**7:00**	4:25	**7:00**	4:25	**7:00**	4:25
3	**6:55**	4:30	**6:55**	4:30	**6:55**	4:30
4	**6:55**	4:30	**7:20**	4:30	**6:55**	4:30
5	**6:55**	4:30	**7:55**	4:30	**6:55**	4:30
6	**6:50**	4:30	**8:30**	4:30	**6:50**	4:30
7	**6:50**	4:30	**9:20**	4:30	**6:50**	4:30
8	**6:50**	4:30	**10:15**	4:30	**6:50**	4:30
9	**6:45**	4:35	**11:15**	4:35	**6:45**	4:35
10	**6:45**	4:35	12:20	4:35	**6:45**	4:35
11	**6:45**	4:35	1:30	4:35	**6:45**	**12:00**
11	.....	.....	.....	.....	1:30	4:35
12	**6:40**	4:35	2:35	4:35	**6:40**	**12:00**
12	.....	.....	.....	.....	2:35	4:35
13	**6:40**	4:35	3:35	4:35	**6:40**	**12:00**
13	.....	.....	.....	.....	3:35	4:35
14	**6:40**	4:35	No	light	**6:40**	**12:00**
15	**6:35**	4:40	No	light	**6:35**	**12:00**
16	**6:35**	4:40	No	light	**6:35**	**12:00**
17	**6:35**	4:40	**6:35**	**7:50**	**6:35**	**12:00**
18	**6:30**	4:40	**6:30**	**8:10**	**6:30**	**12:00**
19	**6:30**	4:45	**6:30**	**8:35**	**6:30**	**12:00**
20	**6:30**	4:45	**6:30**	**9:05**	**6:30**	**12:00**
21	**6:25**	4:45	**6:25**	**9:40**	**6:25**	**12:00**
22	**6:25**	4:45	**6:25**	**10:30**	**6:25**	**12:00**

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
19	7:55	3:45	No	light	7:55	12:00
20	7:50	3:45	No	light	7:50	12:00
21	7:50	3:45	7:50	10:10	7:50	12:00
22	7:50	3:45	7:50	10:30	7:50	12:00
23	7:50	3:50	7:50	10:45	7:50	12:00
24	7:50	3:50	7:50	11:05	7:50	12:00
25	7:50	3:50	7:50	11:20	7:50	12:00
26	7:50	3:50	7:50	11:40	7:50	12:00
27	7:45	3:50	7:45	12:05	7:45	12:05
28	7:45	3:55	7:45	12:30	7:45	12:30
29	7:45	3:55	7:45	1:00	7:45	1:00
30	7:45	3:55	7:45	3:00	7:45	3:00
31	7:40	3:55	7:40	3:55	7:40	3:55

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
19	7:20	4:15	7:20	9:10	7:20	12:00
20	7:15	4:15	7:15	9:25	7:15	12:00
21	7:15	4:15	7:15	9:45	7:15	12:00
22	7:15	4:15	7:15	10:05	7:15	12:00
23	7:15	4:15	7:15	10:30	7:15	12:00
24	7:10	4:20	7:10	11:05	7:10	12:00
25	7:10	4:20	7:10	11:50	7:10	12:00
26	7:10	4:20	7:10	12:40	7:10	12:40
27	7:05	4:20	7:05	1:45	7:05	1:45
28	7:05	4:20	7:05	3:05	7:05	3:05
29	7:05	4:25	7:05	4:25	7:05	4:25
30	7:05	4:25	7:05	4:25	7:05	4:25
31	7:00	4:25	7:00	4:25	7:00	4:25

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
18	6:30	4:40	6:30	8:10	6:30	12:00
19	6:30	4:45	6:30	8:35	6:30	12:00
20	6:30	4:45	6:30	9:05	6:30	12:00
21	6:25	4:45	6:25	9:40	6:25	12:00
22	6:25	4:45	6:25	10:30	6:25	12:00
23	6:25	4:45	6:25	11:30	6:25	12:00
24	6:20	4:50	6:20	12:40	6:20	12:40
25	6:20	4:50	6:20	2:00	6:20	2:00
26	6:20	4:50	6:20	3:20	6:20	3:20
27	6:15	4:50	6:15	4:40	6:15	4:40
28	6:15	4:55	6:15	4:55	6:15	4:55
29	6:15	4:55	6:15	4:55	6:15	4:55
30	6:15	4:55	6:15	4:55	6:15	4:55

October, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	6:10	4:55	6:10	4:55	6:10	4:55
2	6:10	4:55	6:10	4:55	6:10	4:55
3	6:05	5:00	6:20	5:00	6:05	5:00
4	6:05	5:00	7:10	5:00	6:05	5:00
5	6:05	5:00	8:05	5:00	6:05	5:00
6	6:05	5:00	9:10	5:00	6:05	5:00
7	6:00	5:00	10:15	5:00	6:00	5:00
8	6:00	5:05	11:20	5:05	6:00	5:05
9	6:00	5:05	12:25	5:05	6:00	5:05
10	5:55	5:05	1:30	5:05	5:55	12:00
10	.....	.....	.....	.....	1:30	5:05
11	5:55	5:05	2:30	5:05	5:55	12:00
11	.....	.....	.....	.....	2:30	5:05
12	5:55	5:05	3:30	5:05	5:55	12:00
12	.....	.....	.....	.....	3:30	5:05
13	5:50	5:10	No	light	5:50	12:00
14	5:50	5:10	No	light	5:50	12:00
15	5:50	5:10	No	light	5:50	12:00
16	5:45	5:10	No	light	5:45	12:00
17	5:45	5:10	5:45	7:05	5:45	12:00
18	5:45	5:15	5:45	7:40	5:45	12:00
19	5:45	5:15	5:45	8:25	5:45	12:00
20	5:40	5:15	5:40	9:20	5:40	12:00
21	5:40	5:15	5:40	10:25	5:40	12:00
22	5:40	5:20	5:40	11:40	5:40	12:00
23	5:35	5:20	5:35	1:00	5:35	1:00
24	5:35	5:20	5:35	2:15	5:35	2:15
25	5:35	5:20	5:35	3:35	5:35	3:35
26	5:35	5:20	5:35	4:50	5:35	4:50
27	5:30	5:25	5:30	5:25	5:30	5:25
28	5:30	5:25	5:30	5:25	5:30	5:25
29	5:30	5:25	5:30	5:25	5:30	5:25
30	5:30	5:25	5:30	5:25	5:30	5:25
31	5:25	5:30	5:25	5:25	5:25	5:25

November, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	5:25	5:30	5:50	5:30	5:25	5:30
2	5:25	5:30	6:50	5:30	5:25	5:30
3	5:20	5:30	8:00	5:30	5:20	5:30
4	5:20	5:30	9:05	5:30	5:20	5:30
5	5:20	5:35	10:15	5:35	5:20	5:35
6	5:20	5:35	11:20	5:35	5:20	5:35
7	5:20	5:35	12:20	5:35	5:20	5:35
8	5:20	5:35	1:20	5:35	5:20	12:00
8	.....	.....	.....	.....	1:20	5:35
9	5:15	5:40	2:20	5:40	5:15	12:00
9	.....	.....	.....	.....	2:20	5:40
10	5:15	5:40	3:25	5:40	5:15	12:00
10	.....	.....	.....	.....	3:25	5:40
11	5:15	5:40	No	light	5:15	12:00
12	5:15	5:40	No	light	5:15	12:00
13	5:15	5:40	No	light	5:15	12:00
14	5:10	5:45	No	light	5:10	12:00
15	5:10	5:45	5:10	6:25	5:10	12:00
16	5:10	5:45	5:10	7:15	5:10	12:00
17	5:10	5:50	5:10	8:20	5:10	12:00
18	5:10	5:50	5:10	9:30	5:10	12:00
19	5:10	5:50	5:10	10:45	5:10	12:00
20	5:10	5:50	5:10	12:00	5:10	12:00
21	5:05	5:55	5:05	1:15	5:05	1:15
22	5:05	5:55	5:05	2:30	5:05	2:30
23	5:05	5:55	5:05	3:50	5:05	3:50
24	5:05	5:55	5:05	5:05	5:05	5:05
25	5:05	6:00	5:05	6:00	5:05	6:00
26	5:05	6:00	5:05	6:00	5:05	6:00
27	5:05	6:00	5:05	6:00	5:05	6:00
28	5:05	6:00	5:05	6:00	5:05	6:00
29	5:05	6:00	5:05	6:00	5:05	6:00
30	5:05	6:00	5:05	6:00	5:05	6:00

December, 1913

Night of	Table No. 1 All-Night Lighting		Table No. 2 Standard or Philadelphia System		Table No. 3 Frund System	
	Light	Exting.	Light	Exting.	Light	Exting.
1	5:05	6:00	6:50	6:00	5:05	6:00
2	5:05	6:05	8:00	6:05	5:05	6:05
3	5:05	6:05	9:05	6:05	5:05	6:05
4	5:05	6:05	10:10	6:05	5:05	6:05
5	5:05	6:05	11:10	6:05	5:05	6:05
6	5:05	6:05	12:10	6:05	5:05	6:05
7	5:05	6:10	1:10	6:10	5:05	12:00
7	.....	.....	.....	.....	1:10	6:10
8	5:05	6:10	2:15	6:10	5:05	12:00
8	.....	.....	.....	.....	2:15	6:10
9	5:05	6:10	3:20	6:10	5:05	12:00
9	.....	.....	.....	.....	3:20	6:10
10	5:05	6:10	4:30	6:10	5:05	12:00
10	.....	.....	.....	.....	4:30	6:10
11	5:05	6:10	No	light	5:05	12:00
12	5:05	6:15	No	light	5:05	12:00
13	5:05	6:15	No	light	5:05	12:00
14	5:05	6:15	No	light	5:05	12:00
15	5:05	6:15	5:05	7:20	5:05	12:00
16	5:05	6:15	5:05	8:35	5:05	12:00
17	5:05	6:15	5:05	9:50	5:05	12:00
18	5:05	6:15	5:05	11:05	5:05	12:00
19	5:05	6:15	5:05	12:20	5:05	12:20
20	5:05	6:15	5:05	1:35	5:05	1:35
21	5:05	6:15	5:05	2:50	5:05	2:50
22	5:05	6:15	5:05	4:05	5:05	4:05
23	5:05	6:20	5:05	5:25	5:05	5:25
24	5:05	6:20	5:05	6:20	5:05	6:20
25	5:10	6:20	5:10	6:20	5:10	6:20
26	5:10	6:20	5:10	6:20	5:10	6:20
27	5:10	6:20	5:10	6:20	5:10	6:20
28	5:10	6:20	5:10	6:20	5:10	6:20
29	5:10	6:20	5:40	6:20	5:10	6:20
30	5:10	6:20	6:50	6:20	5:10	6:20
31	5:10	6:20	7:55	6:20	5:10	6:20